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ABSTRACT

Various collaborative efforts involved in implementing a district-developed science curriculum are described in four papers. "The Design and Utilization of a Concerns-Based Staff Development Program for Implementing a Revised Science Curriculum in Eighty Elementary Schools" (Harold Pratt, Marge Melle, Jim Metzdorf, Susan Loucks) reports on how a concerns-based adoption model was used to design a staff development program to support innovation implementation. "Implementation of a District-Wide Science Curriculum: The Effects of a Three Year Effort" (Susan Loucks, Marge Melle) reports on the quantitative data collected from teachers throughout the study. Also included is a dialogue between the authors, a researcher, and a practitioner which reflects implications of the work from their different perspectives. "Implementation at the School Building Level: The Development and Analysis of Nine Mini-Case Studies" (Gene Hall, Shirley Hord, Teresa Griffin) reports on various school level influences, such as principal behaviors and the timing of interventions which affect an otherwise standardized district-wide implementation. "The Effects of a Concerns-Based Implementation Plan on the Achievement of Elementary Science Students" (Harold Pratt, Susie Winters, Archie George) describes the development and use of an achievement measure related to the innovation's goals. Comments from symposium discussants and questions from the audience are included. (Author/JN)

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MAKING CHANGE HAPPEN: A CASE STUDY OF SCHOOL DISTRICT IMPLEMENTATION

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

A symposium of four papers presented at the annual meeting of the American Educational Research Association, Boston, 1980.

P & D Report No. 3103

With remarks by discussants:

Joseph Vaughan
Ann Lieberman
Patricia Zigarmi

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ABSTRACT

The work reported in this symposium demonstrates that practitioners, researchers and policy makers can work together effectively to deal with complex educational issues which require an interdisciplinary, multiperspective approach. Staff of a national R&D Center and a large school district collaborated in a three year effort involving the implementation of an educational innovation (a district-developed science curriculum). The symposium papers report on research on the change process, staff development based on implementation data, and evaluation dimensions.

The paper, "The Design and Utilization of a Concerns-Based Staff Development Program for Implementing a Revised Science Curriculum in Eighty Elementary Schools," by Harold Pratt, Marge Melle, Jim Metzdorf (Jefferson County, Colorado Public Schools--Jeffco) and Susan Loucks (Research and Development Center for Teacher Education, University of Texas at Austin--UTR&D), reports on how the UTR&D-developed Concerns-Based Adoption Model (CBAM) was used to design staff development to support innovation implementation. Design features and utilization of research data to monitor and refine the effort through implementation are described.

"Implementation of a District-Wide Science Curriculum: The Effects of a Three Year Effort," by Susan Loucks (UTR&D) and Marge Melle (Jeffco) reports the quantitative data -- Stages of Concern About the Innovation (SoC) and Levels of Use of the Innovation (LoU) -- collected from teachers throughout the study. Findings reflect a predictable progression through concerns and use levels through first use, and then many variations as individual teachers gained experience in curriculum use. District staff also measured extent of implementation through identification of curriculum components and assessment along these components. These data are reported in order to complete a picture of district-wide implementation effects. Finally, a dialogue between the authors, a researcher and a practitioner, reflects implications of the work from their different perspectives.

In "Implementation at the School Building Level: The Development and Analysis of Nine Mini-Case Studies," Gene Hall, Shirley Hord and Teresa Griffin report on events ongoing within a sample of ten schools. Concurrent with quantitative data collection, an ethnographer was employed during the first two years to observe the change effort, focusing on interventions. District staff also recorded observations. UTR&D staff compiled each school's quantitative and qualitative data, developing a mini-case study on each. These reports reflect school-level influences, such as principal behaviors and the timing of interventions, that affect an otherwise standardized district-wide implementation.

"The Effects of a Concerns-Based Implementation Plan on the Achievement of Elementary Science Students" by Harold Pratt, Susie Winters (Jeffco) and Archie George (UTR&D), describes the development of a student achievement measure, a criterion-referenced test directly related to the innovation's goals. Three groups of students drawn from schools in three phases of the implementation were identified based on CTBS reading scores. The data indicate a definite

trend toward increased student achievement in those classrooms where the innovation had been implemented for a longer time period.

Following the papers, is a transcription of the dialogue conducted by discussants who focused on research findings and implications for change research, design of evaluation studies, and facilitative staff development. The three discussants are: Joseph Vaughan, National Institute of Education; Ann Lieberman, Teachers College, Columbia University; and Pat Zigarmi, Research and Development Center for Teacher Education.

THE DESIGN AND UTILIZATION OF A CONCERNS-BASED STAFF DEVELOPMENT PROGRAM FOR IMPLEMENTING A REVISED SCIENCE CURRICULUM IN EIGHTY ELEMENTARY SCHOOLS

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Paper presented at the annual meeting of the
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Boston, April, 1980

THE DESIGN AND UTILIZATION OF A CONCERNS-BASED STAFF DEVELOPMENT PROGRAM FOR IMPLEMENTING A REVISED SCIENCE CURRICULUM IN EIGHTY ELEMENTARY SCHOOLS[1]

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Marge Melle

Jim Metzdorf

Susan Loucks

For the past three years the Jefferson County, Colorado Public Schools (Jeffco) and the Research and Development Center for Teacher Education at the University of Texas at Austin (UTR&D) have been jointly designing and carrying out a concerns-based staff development plan for the purpose of supporting the implementation of a revised science program for grades 3-6 in 80 elementary schools. Rarely have such distinct, different and geographically separated educational agencies joined forces on such an extensive project. The results have been mutually beneficial to both groups and are reported in a series of papers in this symposium (Loucks & Melle, 1980; Hall, Hord & Griffin, 1980; Pratt, Winters & George, 1980).

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[1]The research described herein was conducted under contract with the National Institute of Education. The opinions expressed are those of the authors and do not necessarily reflect the position or policy of the National Institute of Education, and no endorsement by the National Institute of Education should be inferred.

This paper describes both the revision of the elementary science program and how the two institutions collaborated on designing a staff development program for implementing the revision. The Concerns-Based Adoption Model (CBAM) was applied to facilitate the transition to the new science program. The basic assumptions of CBAM are outlined, then the ways in which the model was utilized are illustrated.

The Setting: Jefferson County Public Schools (Jeffco)

Jeffco was created in 1951 by the consolidation of 39 separate school districts, becoming the first district to reorganize under a new Colorado state law. Although the first years of the new district's life were rocky at best, a precedent for change and innovation was set as the district's norm. During the early years after reorganization a district-wide, uniform curriculum was established, in order to provide "glue" to connect and unify the various community and school differences.

A sample of innovations tried and implemented over the past twenty years serves as testimony to the district norm for change:

> A) Schools in the district have been national field test sites for NSF elementary (ESS) and secondary (BSCS, IPS, ESCP, PSSC) science curricula; for Man: A Course of Study social studies curriculum; and for the Wisconsin Research and Design reading program. The math department developed the Systematic Teaching Assessment and Measurement in Mathematics (STAMM) math curriculm, currently disseminated nationally through the National Diffusion Network. Although some have been revised to meet current educational needs, these programs are presently used as part of the district curriculum. Programs in outdoor education, arts in education, environmental education, and family living have also been locally developed and implemented, and serve as recognized models for other districts in the region and the nation.

B) School level innovations have also taken place. These include modular scheduling, open space and flexible space facilities, team teaching, departmentalized, multi-aged clases, and I.G.E.

C) Other innovations include year-round schools effecting 35% of the K-12 students, two district-owned outdoor lab schools where all sixth grade students spend one week, an open living school, and a fundamental alternative school.

In 1980, the district had approximately 80,000 students enrolled in 76 elementary schools, 19 junior high schools and 14 high schools including an occupational technical center. After 27 years of constant and sometimes rapid growth the student enrollment peaked in 1978-79 at 81,150. Four elementary schools and 1 junior high were closed in 1978 in the central, declining-enrollment area, while at the same time 3 new elementary and 2 new junior high schools were planned to open in 1980 in the growth areas of the district. The 1979 budgeted cost per pupil is $1,958, which is 9th out of the 15 Denver-metro area school districts in total expenditure per student.

A well-defined curriculum development process emerged in 1974 (Jefferson County Public Schools, 1974). This process includes: needs assessment, curriculum objective statements, curriculum writing, pilot testing-evaluation[2], field testing evaluation and district-wide implementation. The process involves central office curriculum personnel in getting approval and "buy-in"

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[2]The pilot test evaluation is carried out by a small number of highly qualified teachers who refine the materials and test them in "ideal" classrooms. The field test evaluation the following year is conducted in a relatively large number of randomly selected classrooms. The purpose of the field test is to determine the management problems that typical teachers encounter with the new materials in a wide variety of classroom settings.

from several groups. These groups include lay/professional curriculum councils, principal groups, the Superintendent and the Board of Education. The curriculum development process assures budget support and personnel time allocation for both development and initial implementation. Board approved procedures specify that a given amount of instructional time will be spent on each subject area.

Although the curriculum development process had been in place for several years, no companion process for implementation had been developed. The time period, depth of detail, style of inservice leaders, and follow-up in schools varied from department to department.

A district staff development office was created in 1974. One of its functions is assisting the curriculum departments in implementing programs. When the revised elementary science program reached the implementation phase of development at the completion of field test in 1976, the staff development office sought a model for implementation which might be adopted/adapted by the district.

The Innovation: A Revised Elementary Science Curriculum

The elementary science program in place prior to the revision had been implemented in 1969. At that time inservice was held in each school or group of schools as part of the implementation. The "hands-on" inquiry oriented curriculum, which required using no textbooks, consisted mainly of Elementary Science Studies (ESS) units, with the inclusion of some Science Curriculum Improvement Study (SCIS) and Mini-Mast units in the primary grades.

In successive years systems for organizing and replenishing materials within the schools were refined and continued inservices were offered and well attended. These inservices were held on a voluntary basis, which meant that many

teachers threatened by or disinterested in teaching science (the ones who needed it most) probably did not receive help. The number of teachers in this category was estimated to be significant. In addition, new teachers received little training from schools of education as facilitators in the inquiry method of teaching, had no personal experience in learning science in this mode, and were usually not strong in their science content background. In 1973, the revision of the elementary science curriculum was begun, based on the following needs:

1. New district goals and student outcome statements had been adopted to describe what the "Jeffco community thinks a graduate of our schools should look like, act like, and be prepared to do when he leaves high school," (Jefferson County Public Schools, 1974). The curriculum needed to be modified to meet these goals.

2. The original program was weak in the area of life science. Teacher observation and research (Whitla, 1973; BSCS, 1975) indicated that students were very interested in themselves and their physical, biological and social environment. With this knowledge the decision was made to strengthen the health and environment education areas of the curriculum.

3. The "back to basics" movement, with its strong emphasis on reading, mathematics and language arts, reduced the time and effort given to science in many schools. In order to promote better learning and maximize instructional time, specific application and reinforcement of identified basic skill objectives would be incorporated into science activities.

4. A more precise definition of expectations placed upon teachers and students was needed to help teachers better understand open-ended science activities. A set of performance objectives which clearly defined expectations of students, as well as processes of measuring and assessing student performance, was needed.

The program developers retained the most successful ESS units, added an adapted version of the SCIS life science strand, and wrote units around pieces from BSCS, ESS, and other sources for the health science. Locally written astronomy units integrated classwork with the district planetarium. Outdoor activities were added to the commercially produced ESS and SCIS units.

Objectives and assessments, as well as references to basic skill objectives, were produced for each unit. Today, the district guides, consisting of one notebook for each grade level, act as "roadmaps" through commercial guides from ESS and SCIS which outline activities the teachers are to use. These guides also show where teachers may supplement with outdoor activities, identify what media will reinforce the concept, suggest how to evaluate students, and include a complete set of worksheets.

The total program, grades 3-6, is delineated in four content strands: health, physical, environmental sciences, and earth science/astronomy. The curriculum is not written on a spiral basis, rather, each unit is discreet within itself. However, there is a continuity of the units within the health and environmental sciences strand. Figure 1 is a matrix of the curriculum, grades 3-6.

Figure 1

REVISED ELEMENTARY SCIENCE CURRICULUM CONTENT STRANDS

	Health Science	Physical Science	Environmental Science	Earth Science/ Astronomy
Gr. 3	Dental Health Your Senses	Structures	Populations Ice Cubes	What's Up There?
Gr. 4	Bones	Mystery Powders	Environments & Mealworms Crayfish	Rocks & Charts Operation Sky Watch
Gr. 5	Human Body Systems Reproductive System (a family living unit)	Batteries & Bulbs	Communities & Small Things	Space: The New Frontier
Gr. 6	Nervous System & Decision Making	Optics Kitchen Physics Gases & Airs (optional)	Ecosystems Ecosystems Supplement Microgardening (optional)	Tools of Astronomy

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The curriculum for K-2 was not included in the 1977 science revision because the kingergarten material had been absorbed into an integrated-day-approach. The program developers are currently working with several other departments to integrate science, social studies, environmental education, health, and career education into a single guide for grades 1 and 2.

THE CHANGE MODEL: THE CONCERNS-BASED ADOPTION MODEL

As previously stated, the science revision had just successfully completed its field test in 1976, and implementation across the district had been tentatively planned. Jeffco personnel renewed acquaintances with researchers from the Research and Development Center for Teacher Education at the University of Texas at Austin where a model for change was under development. That model, whose underlying assumptions matched those of Jeffco staff developers and science department staff, became the framework for planning the implementation effort (Loucks & Pratt, 1979).

The Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973) views change as a process, not an event. Thus, it requires a long-range perspective for implementing any new program, along with a commitment for providing necessary time and resources. Furthermore, change is a highly personal experience that affects individuals differently; thus, a major part of the assistance must be targeted at the needs of the individual teacher rather than the school or district. Finally, individuals appear to follow a predictable pattern of growth in both their feelings about and their skills in using new programs, progressing as they become more familiar with and experienced in use.

When the Jeffco and Texas work crossed paths two dimensions of the CBAM had already been verified -- Stages of Concern About the Innovation and Levels of

Use of the Innovation -- and they both influenced the planned implementation. According to the research on concerns (Hall & Loucks, 1978), individuals who adopt new programs experience a progression in concerns, beginning with a need for general information about what the program is and how how they will be affected personally, then moving on to concerns about management and logistics, and finally to concerns about how the program is affecting students and how it can be improved. Figure 2 illustrates the seven Stages of Concern.

Figure 2

STAGES OF CONCERN:
TYPICAL EXPRESSIONS OF CONCERN ABOUT THE INNOVATION

STAGES OF CONCERN	EXPRESSIONS OF CONCERN
6 REFOCUSING	I HAVE SOME IDEAS ABOUT SOMETHING THAT WOULD WORK EVEN BETTER.
5 COLLABORATION	I AM CONCERNED ABOUT RELATING WHAT I AM DOING WITH WHAT OTHER INSTRUCTORS ARE DOING.
4 CONSEQUENCE	HOW IS MY USE AFFECTING KIDS?
3 MANAGEMENT	I SEEM TO BE SPENDING ALL MY TIME IN GETTING MATERIAL READY.
2 PERSONAL	HOW WILL USING IT AFFECT ME?
1 INFORMATIONAL	I WOULD LIKE TO KNOW MORE ABOUT IT.
0 AWARENESS	I AM NOT CONCERNED ABOUT IT (THE INNOVATION).

Since individuals are known to be motivated to learn that which concerns them most at a given point in time, the Jeffco science implementation was

planned to respond to the particular concerns of Jeffco teachers as they emerged. Previous research indicated that the concerns would change over time, so activities targeted at earlier concerns were planned earlier in the implementation. Later, over the course of more than a year, activities targeted at higher concerns were introduced. These are described later in the paper.

A second dimension of the CBAM, Levels of Use (Hall, Loucks, Rutherford, & Newlove, 1975), played a somewhat different role in implementation planning. The eight Levels of Use, defined in Figure 3, describe how the behaviors of individuals can change over time as they implement a new program. For the Jeffco implementation, Levels of Use functioned in goal setting. The goal decided upon during the planning phase was that each student in the district receive "hands-on" inquiry-oriented science instruction, and that each teacher be at a Routine (IVA) Level of Use. This decision influenced the target teacher population, the kind of support provided, and the structure of inservices. Had the goal been all teachers at a Mechanical (III) level, or most teachers at a Refinement (IVB) level or above, very different plans would have been made.

In addition to this "use" goal, it was determined beforehand that the implementation effort should result in low Informational, Personal and Management concerns (Stages 1-3) by the end of the implementation phase. It was hoped that resolving these would allow concerns about students (Stage 4) to dominate science instruction.

Figure 3

LEVELS OF USE OF THE INNOVATION:
TYPICAL BEHAVIORS

LEVEL OF USE		BEHAVIORAL INDICES OF LEVEL
VI	RENEWAL	THE USER IS SEEKING MORE EFFECTIVE ALTERNATIVES TO THE ESTABLISHED USE OF THE INNOVATION.
V	INTEGRATION	THE USER IS MAKING DELIBERATE EFFORTS TO COORDINATE WITH OTHERS IN USING THE INNOVATION.
IV-B	REFINEMENT	THE USER IS MAKING CHANGES TO INCREASE OUTCOMES.
IV-A	ROUTINE	THE USER IS MAKING FEW OR NO CHANGES AND HAS AN ESTABLISHED PATTERN OF USE.
III	MECHANICAL USE	THE USER IS USING THE INNOVATION IN A POORLY COORDINATED MANNER AND IS MAKING USER-ORIENTED CHANGES.
II	PREPARATION	THE USER IS PREPARING TO USE THE INNOVATION.
I	ORIENTATION	THE USER IS SEEKING OUT INFORMATION ABOUT THE INNOVATION.
0	NON-USE	NO ACTION IS BEING TAKEN WITH RESPECT TO THE INNOVATION.

THE PRACTICE: THE USE OF CBAM STRATEGIES IN THE IMPLEMENTATION

When the collaboration between Jeffco and UTR&D began in the spring of 1976, the science program developers and the staff development office had just completed the initial plans for an extensive implementation inservice program to

be conducted over the next two years. One of the first activities of the two groups was to plan with and train 23 carefully selected elementary teachers who would serve as inservice leaders[3]. This took place at the University of Wyoming Science and Math Teaching Center and lasted a full week. With the assumptions of CBAM in mind, the leaders, together with the Jeffco and UTR&D staff reworked the inservice plans.

Assumption #1: Change is a Process--Not an Event

A process takes time. Too often the decision makers in a school system assume that change has occurred on the first day of the new school year if the new guides have been delivered, or if the new teaching pattern such as team teaching, has been outlined for the teachers. As long as the teachers involved in the change do not raise significant questions or problems, it is assumed that change has taken place. However, the Texas research indicates that from three to five years are necessary before the Level of Use of a complicated implementation begins to approach Routine (IVA), which was the long-rang goal o the Jeffco science implementation. Before exposure to Texas work the Jeffco Science Department had scheduled a fairly typical three-day inservice activity for teachers, very near the beginning of the school year. That plan was changed to allow more time between sessions for teachers to use the presented units in their own classrooms. Since the inservice plan for any one school would now require almost a year to complete, the 80 elementary schools in the district were divided into three groups, or phases. Phase II and Phase III schools began their inservice program six months and one year after Phase I, respectively.

[3]An additional eleven leaders were prepared at a similar session the following summer.

Another activity to extend the time in which teachers have to adjust to the change was planned. A series of two preinservice sessions were scheduled approximately two months before the inservice sessions were to begin. Approximately three months prior to that all principals of the schools involved were given a one-half day orientation to the revised program. Ways in which they could inform teachers of the change and support the change process itself were outlined. Even after the last inservice session was completed, contact with teachers was maintained through a planned series of "comfort and caring" visitations by two members of the science department to the classrooms involved. The "change process" was given two years instead of two weeks.

Assumption #2: Change is a Personal Experience

In anticipation of high Stage 1 and 2 concerns the inservice plan called for paying close attention to the individual teachers, who bear the ultimate responsibility in implementing the new program. Principals were given suggestions for personally supporting their teachers through scheduling procedures, provision of equipment and supplies, and simply providing time to discuss the innovation. The preinservice sessions were held in each of the local schools. The sessions were informal and included a small number of teachers so individual questions and concerns could be dealt with readily. Between each of the day-long inservice sessions two of the science staff members began the comfort and caring activities by helping teachers deal with problems they were encountering with the new program.

The inservice sessions themselves were designed so that teachers had choices of activities, depending upon the amount of science teaching experience and confidence they had with elementary science. Teacher to leader ratio was kept small in the inservice sessions, using as leaders trained, enthusiastic

classroom teachers who had already taught the new curriculum. These leaders could often anticipate, and more readily identify with, the problems and questions from the classroom teachers than could the program designers.

Assumption #3: Change Involves Growth in Feelings and Skills

As mentioned above, individuals go through stages in their concerns about an innovation. The pattern is predictable and implementation activities can be planned to match the development of the individuals involved. Because the Jeffco science implementation plan was designed with the Stages of Concern in mind, it is useful to review the chronology of the implementation plan according to the stages.

Stages 0 and 1: Awareness and Informational Concerns. Teachers and principals were informed by a memo from the science department in early spring that they would be involved in preinservice sessions late the next fall and inservice sessions starting in January the following year. They were told which units would be replaced or revised, what equipment would be provided each school, and given a recommended schedule by which they could phase out the old guide and teach the units in the new guide to correspond to the inservice schedule. After the principal orientation in August, teachers were informed again by their principal when they returned to school in September of the preinservice dates and inservice schedule.

Stages 1 and 2: Informational and Personal Concerns. The preinservice was specifically designed to introduce teachers to the reasons for the revision, a few details about the guide, and to inform them of the dates, location and organization of the total inservice plan. A slide tape show was used to orient them to the new program, guides were distributed to all teachers and a brief activity used to introduce its contents and format. A small, informal group

setting, allowed ample time for questions and answers about the entire program. In addition, teachers were reminded of the recommended teaching schedule that would be most useful to them if they wanted to coordiate their teaching with the content of the inservice sessions. At the inservice sessions Personal concerns were addressed by keeping class sizes small so that discussion could occur and by requesting written feedback at the end of each session. As mentioned earlier, Personal concerns were attended to throughout the entire implementation process by means of comfort and caring sessions in the local schools.

Stage 3: Management Concerns. The first inservice session paid particular attention to Management concerns. In an early part of the session specific classroom and equipment management techniques were explained and demonstrated to the teachers. The major portion of the day was spent by teachers actually doing the activities in the science units, with a strong emphasis on "how to do it" by the leaders. A portion of the inservice day was devoted to self-paced instructional modules. One of the modules from which teachers could select was designed to help with management techniques for caring for and maintaining live animals in the classroom, while another was devoted to procedures for conducting outdoor activities. Trained teachers as inservice leaders meant that answers to many questions were available from people with previous classroom experience in that unit. In the next two inservice sessions management technique helps were continued but to a somewhat lesser degree while concerns at higher levels were stressed more.

Stage 4: Consequence Concerns. As expected, the teachers at the inservice sessions varied considerably in their experience, confidence and Stage of Concern. To deal with these individual differences teachers were given a chance to self select the amount of time they spent actually doing a unit, giving them more time to deal with Management concerns. They were also allowed a choice

during the module sessions. If their concerns had progressed to a Consequence stage, modules on Piaget, question techniques such as "wait time," and the use or misuse of science vocabulary were available.

THREE YEARS LATER -- THE PROCESS GOES ON

The outcomes of the above concerns-based implementation plan have been very positive. Results have been reported on a district-wide perspective by Loucks and Melle (1980) and examined at the building level through a series of case studies by Hall, Hord and Griffin (1980). As a result of a heightened awareness created by the model itself, as well as concerns and use data, several new questions and issues have been raised:

1. Two years after the inservice program began most teachers had not reached Consequence concerns. Should they have? If so, how can Consequence concerns be promoted?

2. When Consequence concerns do arise, what type of workshop should be used to address them? Can they be addressed at the district level or is the local building a more appropriate setting? Is a workshop the most appropriate vehicle?

3. New teachers to the district create an ongoing need for the type of inservice and implementation activity described above. Teachers within the district changing assignments from school to school or changing grade level, often revert to a lower Stage of Concern and Level of Use. How much inservice or personal support is necessary to raise their Level of Use and Stage of Concern?

4. How does the principal affect the Stage of Concern or Level of Use of the teachers in his/her building? Do principals themselves have Stages of Concern that in turn affect those of their teachers? If so, how can these be dealt with by the district level change agents?

These questions and others have grown out of the initial implementation activities. Some answers are beginning to emerge and additional activities are being undertaken to resolve the new questions. Evidence from the mini-case studies indicates that the principal is a key figure in arousing concerns at the

Consequence stage. This evidence, together with the results of the program specific evaluation reported by Loucks and Melle (1980), have caused the program developers to begin focusing their attention at the local school level. Concentrated visits coupled with local inservice sessions have been directed at resolving management questions and arousing Consequence concerns. Science Department and other district inservice programs have begun to address these higher level needs with help in questioning skills, grouping students, and improving classroom environment. At the same time, inservice for new teachers, and inservice for new or revised curriculum by other departments, are being designed with Stages of Concern and CBAM assumptions as a basic framework.

Finally, the authors of the symposium hope it is abundantly clear that the UTR&D/Jeffco collaboration has paid dividends for all involved. The researchers added more data in their process of building a better implementation model. The district staff and program developers learned how to build a better implementation/inservice program. The teachers are better prepared to teach science and, most of all, the kids will receive a better learning experience.

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IMPLEMENTATION OF A DISTRICT-WIDE SCIENCE CURRICULUM: THE EFFECTS OF A THREE YEAR EFFORT

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IMPLEMENTATION OF A DISTRICT-WIDE SCIENCE CURRICULUM: THE EFFECTS OF A THREE YEAR EFFORT[1,2]

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The literature abounds with case studies and research reports describing educational change efforts that have "failed" (Berman & McLaughlin, 1975; Charters & Jones, 1973; Goodlad & Associates, 1970; Loucks & Hall, 1979; Schiffer, 1978). Many reasons for this have been suggested: individuals' needs were not addressed; context factors were not taken into consideration; programs were not suited to school needs; not enough time nor funds were allotted. As more and more is learned about the process of change, however, the prospects for effective school improvement become greater.

This paper is one of a series[2] which describes a change effort that succeeded. The effort was designed to take into account what is currently known about successful change, and then to report the effects of the change on schools, teachers and students. The Jefferson County, Colorado Public Schools, a suburban school district which serves 80,000 students, responded to teachers'

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[1]The research described herein was conducted under contract with the National Institute of Education. The opinions expressed are those of the authors and do not necessarily reflect the position or policy of the National Institute of Education. No endorsement by the National Institute of Education should be inferred.

[2]The context and implementation design are detailed in Pratt, Melle, Metzdorf and Loucks (1980). Case study analyses of differences in implementation between various schools are reported by Hall, Hord and Griffin (1980). The effects of the implemented program on students are described by Pratt, Winters and George (1980).

needs by developing a revision of their science curriculum for grades 3-6. Jeffco designed an implementation effort collaboratively with research staff of the Texas Research and Development Center, using the Concerns-Based Adoption Model as a framework. Hopefully, the effort will be the first of many that combine research knowledge with practitioner know-how which may turn the tide of failure in school improvement.

For three years, a representative sample of teachers were monitored to determine the effect of implementation on their concerns and on their general use of the curriculum. For two years, use of the program components by teachers in their classrooms was measured. This paper describes results of these assessments. The paper: (1) briefly describes the implementation design; (2) reports on the effects of the implementation on teachers' concerns, on their Levels of Use, and on their use of curriculum-specific components in the classroom; and (3) draws implications from the findings through a dialogue between researcher and practitioner, the co-authors of the paper.

The Implementation Design

Briefly, the revised curriculum combined a "hands-on," inquiry approach to science instruction with behavioral objectives and assessment techniques. The new teacher's guide included all necessary procedures, references to materials and equipment, and any accompanying worksheets.

The eighty elementary schools in the district were divided into three groups, each beginning implementation at roughly six-month intervals, thus known as either Phase I, II, or III schools. The plan was to create awareness of the new curriculum and provide information about inservice activities at a short faculty meeting two to three months before inservice. Subsequently, three full-day released-time inservice sessions were planned for teachers in each

phase over a nine-month period. These inservices provided "hands-on" experiences with each unit in the curriculum, plus sessions on such topics as classroom management and discussion techniques. See Pratt, Melle, Metzdorf and Loucks (1980) for more detail.

The framework for the implementation design was the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973), a model which views the change process from the perspective of the individual teacher involved. The CBAM is based on the assumption that change is a lengthy, complex and highly personal experience, and that implementation can only be accomplished when the different needs of teachers are met as they emerge.

Two dimensions of the CBAM were utilized in the science implementation. Stages of Concern (see Figure 1) formed the basis for staff development and support activities. Early stages of Awareness, Informational, and Personal concerns (SoC 0, 1, 2), known to be dominant in the beginning of any change effort, were attended to in small, close-knit meetings. Management (Stage 3) concerns, known to emerge during first use, were addressed in the inservice sessions. Because higher Stages of Concern (Stages 4, 5, 6) are known to emerge only with experience and time, if they do, few activities in the implementation were targeted at these concerns. However, several self-paced modules aimed at student-oriented needs (such as implications of Piaget's work for science instruction) were made available during inservice sessions. In general, however, the implementation effort was targeted at lowering Informational, Personal and Management concerns (SoC 1, 2, 3).

Levels of Use (see Figure 2), describing behaviors of teachers as they become increasingly more familiar with and skilled in using a program, provided district staff a tool for goal-setting and informed implementation planning. It

Figure 1

Definitions:

STAGES OF CONCERN ABOUT THE INNOVATION*

0 AWARENESS: Little concern about or involvement with the innovation is indicated.

1 INFORMATIONAL: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.

2 PERSONAL: Individual is uncertain about the demands of the innovation, his/her adequacy to meet those demands, and his/her role with the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision-making and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.

3 MANAGEMENT: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.

4 CONSEQUENCE: Attention focuses on impact of the innovation on students in his/her immediate sphere of influence. The focus is on relevance of the innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.

5 COLLABORATION: The focus is on coordination and cooperation with others regarding use of the innovation.

6 REFOCUSING: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.

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*From: Hall, G. E., George, A. A., & Rutherford, W. L. Measuring stages of concern about the innovation: A manual for use of the SoC questionnaire. Austin: Research and Development Center for Teacher Education, The University of Texas, 1977.

Figure 2

Definitions:

LEVELS OF USE OF THE INNOVATION*

0 NONUSE: State in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.

I ORIENTATION: State in which the user has recently acquired or is acquiring information about the innovation and/or has recently explored or is exploring its value orientation and its demands upon user and user system.

II PREPARATION: State in which the user is preparing for first use of the innovation.

III MECHANICAL USE: State in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.

IVA ROUTINE: State in which use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.

IVB REFINEMENT: State in which the user varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.

V INTEGRATION: State in which the user is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.

VI RENEWAL: State in which the user reevaluates the quality of use of the innovation, seeks major modifications of or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

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*From: The Lou Chart: Operational definitions of Levels of Use of the Innovation. Austin: Research and Development Center for Teacher Education, The University of Texas, 1975.

was decided early in the effort that the goal was to have teachers at least at a Routine Level of Use (LoU IVA) at the completion of the implementation.

The reader is referred for more information to articles about Stages of Concern (Hall & Rutherford, 1976; Hall & Loucks, 1978b) and Levels of Use (Hall & Loucks, 1977; Hall, Loucks, Rutherford & Newlove, 1975) and about their utilization in designing the implementation (Loucks & Pratt, 1979; Pratt, Melle, Metzdorf & Loucks, 1980).

Monitoring Implementation

During the course of the implementation effort, three methodologies were used to assess its effects. Stages of Concern and Levels of Use data were collected five times during the three-year implementation. A third methodology, developed by the science department and district evaluators, identified programspecific components and used these as the basis for measuring the extent of implementation in another set of schools.

The next section discusses the measurement procedures and findings that resulted from the three methodologies. Stage of Concern and Level of Use data are reported together, since the sample of teachers was the same; little detail about measurement is provided, since such items as instrument development are discussed at length elsewhere. The use of program components as an assessment device, and the results of this methodology, are discussed in greater depth, since references have limited availability.

Stage of Concern and Level of Use Assessment

Instrumentation and data collection. Stages of Concern data were collected utilizing the 35-item SoC Questionnaire (Hall, George & Rutherford, 1977) and Levels of Use data were collected utilizing a focused interview procedure

(Loucks, Newlove & Hall, 1976). For Levels of Use assessment, to be considered a "user" of the revised science program (LoU III and above), a teacher had to utilize the teacher's guide to teach at least 80% of the science units. This was considered minimum use. Both concerns and use were collected twice a year for the first two years and once at the end of the third year of the effort. A sample of nineteen schools were selected to represent different phases of implementation. All teachers of grades three through six were included initially, and these same teachers were followed through the final year.

Findings. How did the concerns of teachers about the revised science program change over time? Figure 3 presents concerns data for teachers from a sample of Phase I schools (data are presented by phase since implementation activities were timed differently for different phases). The first measure of concern, fall, 1976, occurred before any inservice activities. Note that concerns are highest at the lower stages, SoC 0, 1, and 2. This is typical of nonusers. By spring, 1977, after two days of inservice training and beginning use of the new curriculum, Stages 0 through 3 have dropped in intensity, with no increases except in Refocusing (SoC 6) concerns. In both fall, 1977, and spring, 1978, the highest Stage of Concern is Management (SoC 3)[3], with Refocusing (SoC 6) concerns still high. This trend continues through another year as spring, 1979, data illustrate.

The bottom of Figure 3 displays LoU data for Phase I teachers. Note that these teachers shifted from predominately LoU II Preparation (fall, 1976) to LoU

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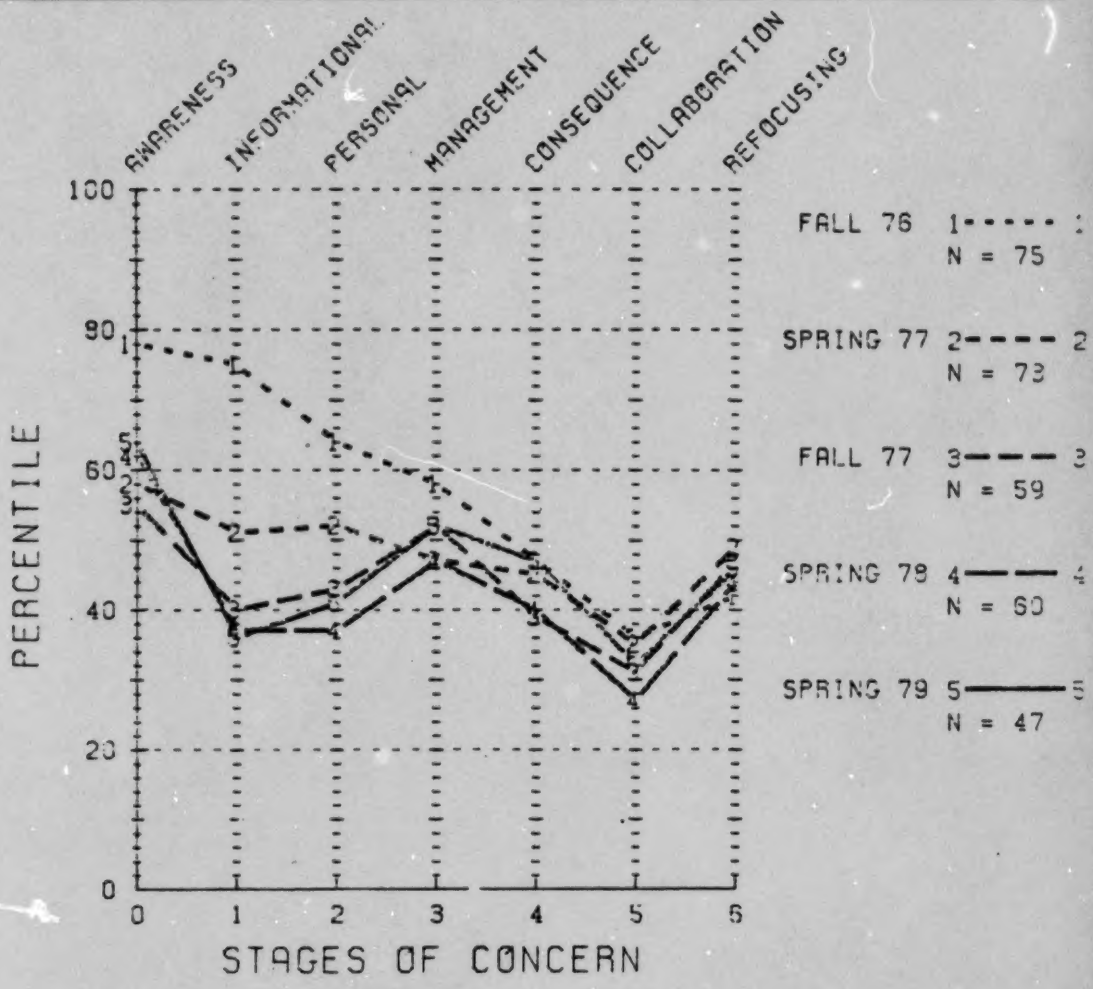
[3]The consistently high Stage 0 scores evident in this study are interpreted to mean that this science curriculum was not viewed as a major change by the teachers responding. See Hall, George & Rutherford, 1977, for special interpretation of Stage 0 scores.

Figure 3

STAGES OF CONCERN AND LEVELS OF USE DATA FOR PHASE I SCHOOLS



LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
FALL 76	5	9	83	1	1	0	0	0	N = 75
SPRING 77	0	4	9	53	24	7	1	1	N = 74
FALL 77	3	3	5	38	35	0	13	3	N = 63
SPRING 78	2	3	2	42	34	13	3	2	N = 62
SPRING 79	6	0	2	23	52	13	0	4	N = 52

PERCENT AT EACH LOU

III Mechanical Use (spring, 1977) in the first year. By fall, 1977 (one year after introduction of the program), there is some decrease in the proportion of Mechanical users to users at Routine and higher levels. In spring, 1978, there are still a significant number of teachers at LoU III Mechanical Use. By the final data collection period, two and a half years after initial inservice, a majority of the teachers are at the Routine level, LoU IVA.

Figure 4 displays data for teachers from a random sample of Phase II schools, as a point of contrast to Phase I teachers. Note the major differences: in fall, 1976, Stages 0-2 of Phase II teachers were higher than Phase I teachers; Stage 6 concerns were never as pronounced in Phase II teachers. By spring, 1978, Consequence concerns (SoC 4) predominated in Phase II teachers, while Management concerns (SoC 3) predominated in those at Phase I. By the next year, Management concerns (SoC 3) had decreased even further, and Refocusing concerns (SoC 6) increased to become even with Consequence concerns (SoC 4).

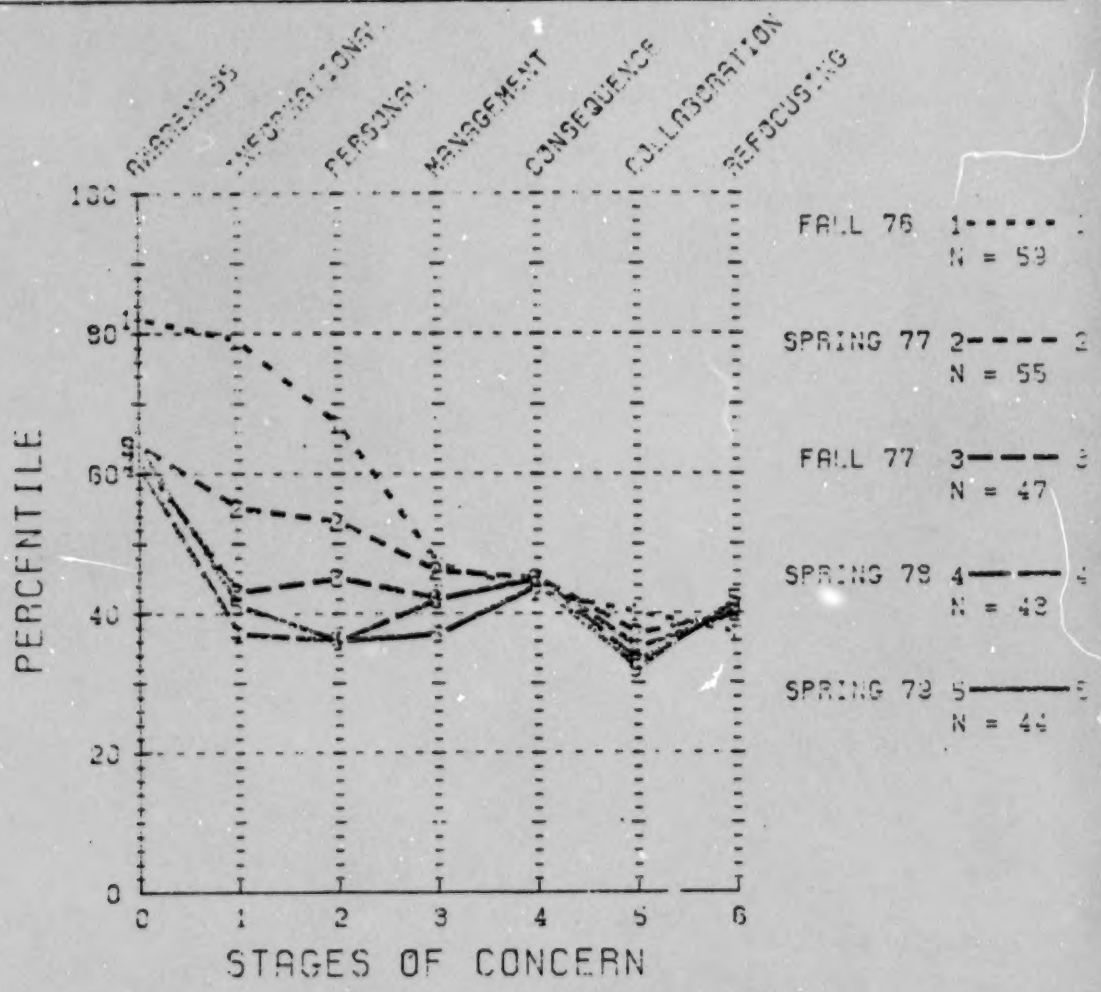
Level of Use data displayed at the bottom of Figure 4 reflect the fact that inservice activities for Phase II came several months after those conducted for Phase I teachers. Note that in spring, 1978, Levels of Use for Phase II teachers still were predominately at LoU III Mechanical Use. By spring, 1979, Levels of Use began to predominate at Routine level and higher.

The changing concerns of Phase III teachers are displayed in Figure 5. These teachers did not begin inservice until January, 1978, which explains the high Stage 0, 1, and 2 concerns during the first three data collection periods. Only in spring, 1979, did these lower stage concerns decrease significantly. At this time, Consequence concerns (SoC 4) emerged as highest.

Phase III use data (see bottom of Figure 5) indicate no significant use of the program until spring, 1978, following shortly after their first inservice.

Figure 4

STAGES OF CONCERN AND LEVELS OF USE DATA FOR PHASE II SCHOOLS



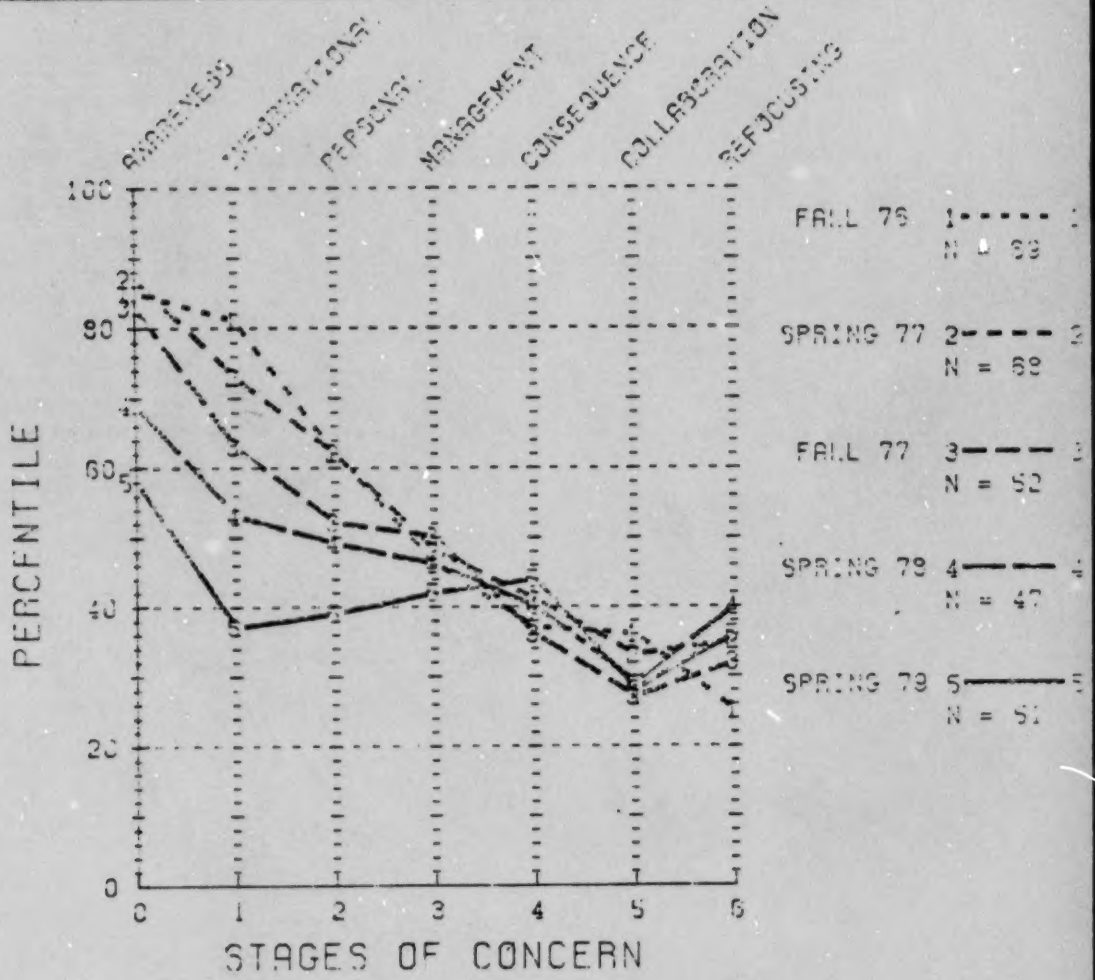
LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
FALL 76	53	3	17	5	17	5	0	0	N = 50
SPRING 77	7	5	43	18	21	3	0	2	N = 50
FALL 77	4	11	11	40	23	6	4	2	N = 53
SPRING 78	9	2	2	44	24	16	0	2	N = 45
SPRING 79	5	0	2	40	40	12	0	2	N = 43

PERCENT AT EACH LOU

Figure 5

STAGES OF CONCERN AND LEVELS OF USE DATA FOR PHASE III SCHOOLS



LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
FALL 76	80	14	1	3	0	0	0	1	N = 88
SPRING 77	66	3	24	6	0	0	0	1	N = 70
FALL 77	12	16	63	4	6	0	0	0	N = 51
SPRING 78	8	14	6	42	22	4	2	2	N = 50
SPRING 78	16	2	0	25	41	12	2	2	N = 51

PERCENT AT EACH LOU

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At that time, use was largely at the Mechanical level. One year later, however, the majority of users were at Routine or higher levels.

Discussion of concerns and use findings. The science implementation effort was designed to resolve early concerns at Stages 0-3 and facilitate the development of Routine (LoU IVA) use. Phase I teacher data indicate that Stage 1 and 2 concerns were largely resolved by the spring of 1979, (sixteen months after the first inservice), but Stage 3 (Management) concerns remained high. The high Stage 6 (Refocusing) concerns in conjunction with Stage 3 (Management) concerns suggest that teachers were still uncomfortable with their management problems and had (or were looking for) better ways of teaching the science curriculum. Level of Use data indicate that, after three years, most teachers had routinized their use of the program.

Similarly, the Stage 1 and 2 concerns of Phase II teachers were greatly decreased in intensity by spring, 1979. However, in contrast, Phase II teachers showed Consequence concerns emerging over Management concerns. Here, too, most of the teachers had reached a Routine level. Similarly, although somewhat behind, Phase III teachers' lower stage concerns had been resolved and Consequence concerns were emerging as dominant. As in Phases I and II, Routine use had been reached by a majority of the teachers.

Two trends in these data are notable. First, concerns and use changed in the hypothesized direction. Lower Stages of Concern were resolved over time, and relative to these lower stages, higher Stages of Concern were aroused. Levels of Use increased, with a majority of users reaching Routine level or above by the third year of data collection. This could be characterized as a "normal" evolution of concerns and use during the course of an implementation (Hall & Loucks, 1978).

The second trend is somewhat more subtle, and is characterized by differences between phases. After inservice training, Management concerns always dominated in teachers of Phase I. Management concerns never dominated in Phase II teachers, and in Phase III, Management concerns diminished and Consequence concerns emerged as highest.

There are several possible explanations for these differences. First, with the large amount of materials and equipment, as well as required behavior change, one would expect high Management concerns from all groups. The fact that these lingered only in Phase I teachers may attest to the fact that facilitators, over time, may have improved in their skills in supporting implementation. Phase II and III teachers received more on-target assistance, more timely delivery of supplies and equipment, and more practiced, refined inservice training. Another explanation for why Phase II teachers' Management concerns never dominated lies in the difference between these teachers and those in Phase I and III schools. Phase II schools are on year-round calendars and are thought generally to be more "progressive," innovative schools in the system. Flexibility and team work are demanded by the situation. These schools are also located in growing parts of the district and tend to have younger staffs. Thus, teachers in these schools may have taken the science revision much more "in stride," or compared to all the other logistical manuverings required of them, they may not have felt very bothered by the new demands. Conversely, teachers in Phase I and III schools, which are more "settled," may have perceived the changes as more of a hassle.

The Levels of Use differences are also interesting. Most outstanding is the fact that Phase III teachers moved to Routine use in a year less time than those in Phase I. This, again, may be due to better implementation assistance

and support. In addition, one reason why Phase I teachers took as long as they did was that there were major grade level shifts in teachers' grade level assignments in Phase I schools between years 1 and 2. This meant teachers were teaching new units for which they lacked inservice training and experience. Phase III teachers did not experience such major shifts in grade level assignment.

Why, after two years, are such a significant number of Phase II teachers still at a Mechanical level? Perhaps another characteristic of the innovative Phase II schools, multi-age grouping, contributes to this situation. A management procedure followed in multi-age schools is for teachers to use one grade level's science units one year, and the other grade level's units the second year. Thus, in the second year of implementation, most Phase II teachers were teaching new units -- ones for which they were not inserviced. A situation similar to Phase I schools, but on a larger scale.

It is interesting to note, with all the contextual changes and competing demands on Jeffco teachers, tha approximately two-thirds of them attained a Routine Level of Use, and managed to resolve most of their lower Stages of Concern. Thus, three years after initiating the implementation effort, the goals of the facilitators had been achieved for most of the teachers.

Assessing Implementation in Terms of Program-Specific Components

The program developers/implementors welcomed Levels of Use assessment as useful in monitoring the early progress of the implementation effort. The time and cost efficiency of its use in a large district made it particularly feasible. For the purpose of the LoU interviews, use of the program was defined as the teacher's use of the district teacher's guide. As there could be many ways teachers could implement the strategies found in the guide, the developers saw a

need for an expanded definition to include other components in addition[4]. This definition needed to be in terms unique and specific to the total science program.

The goal of the science department staff was to enhance science learning for students by implementing teaching practices that would optimize learning. Thus, an operational description was sought to specify what the program would look like when it was implemented in the best possible manner, offering the maximum learning potential. With operational descriptions staff members could monitor the extent of implementation of each of the program-specific components. Staff development strategies could then be introduced which would enable teachers to improve instruction for students.

Twelve components of the elementary science program were identified and described in their ideal form. They clustered in three categories. These components and categories are described in Figure 6.

Instrumentation and data collection. Once the program components were defined, detailed descriptions of each were written in order to measure as objectively as possible the extent to which each component was in place in any one classroom. The behaviors were placed on a 5-point Likert scale: 1--outside the intended program; 2-3--getting a good start; 4--well on the way; 5--best prac-

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[4]This effort may have been influenced by the researchers' sharing with the science staff the concept of innovation configurations. Configurations are the different patterns of use that result when individual users vary the components of a program. For information about the concept and identification procedures, see Hall and Loucks (1978a).

Figure 6

COMPONENTS OF THE SCIENCE PROGRAM

I. Program components over which district policy or procedure appear to have the major influence for implementation in the classroom:

1. The recommended percentage of teaching time during the day is devoted to science. An average of 15% of the student's day (10% for third grade) should be devoted to science.

2. Science is taught according to the district guide. During the school year the teacher teaches all units, all objectives of each unit and 90% of the activities.

3. Students' learning is assessed according to the district science guide. According to a review of each unit, the teacher uses the guide assessments with students 85% of the time.

4. Basic skills, as differentiated by the continuum in each curriculum area, are being integrated into the science program. The basic skills keyed in the guide are being introduced or stressed in their subject area time allotment while they are being reinforced during science instruction.

5. The outdoors is used as a classroom when recommended. Whenever outdoor activities are recommended as part of a unit, they are always included.

II. Program components over which the building principal and the teacher both have a major responsibility for influencing implementation in the building and classroom:

6. All materials, equipment and media are available. Appropriate commercial guides and the district guide are available for use. Enough materials are available for individual or small group usage. A storage system of logical sequence is established.

7. Principals have arranged for release of teachers for the total inservice training package and have allocated financial support to the program.

8. Long and short-range planning is evident. The year's schedule is written out and being implemented by the teacher or the team. This schedule reflects attention to seasonal demands, sharing of materials, and maximum utilization of space and personnel. Before each unit is taught, overall planning for that unit takes place.

III. Program components over which the teacher has the major influence for implementation in the classroom:

9. Class time in science is used efficiently and effectively (time on task). At least 75% of the class time is devoted to exploration, pupil interaction, recording data, discussions and listening to each other. An efficient management system for distribution and clean-up of materials is evident.

10. Teacher-student interaction facilitates the program. Using the students' language, the teacher shares with students the objectives of the units. Discussion techniques include: neutral rewarding, wait time, questions above recall level, maximized use of student-student discussion; and data sharing.

11. The classroom environment and arrangement facilitates student-student interaction in small groups. Furniture and materials are arranged in order to facilitate small group interaction. Student behaviors include sharing of materials, listening to each other, working together towards a group goal, and interacting with each other (cooperative learning). Students are task-oriented most of the time.

12. The instruction in the classroom follows the stages of the learning cycle in science: exploration, concept formation, concept application.

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tices in operation. An example component appears in Figure 7. Further descriptors are found on data reports, Figures 10 through 14 of the Findings section.

Instruments and data recording sheets for use in monitoring the extent of implementation of the program as defined by the twelve components were developed by the district Department of Evaluation (Darnell, 1979). These included a focused teacher interview, a classroom observation checklist, a focused principal interview, and a focused media specialist interview.

The assessment of implementation took place after the inservice program had been completed during the second year of implementation in Phase I and Phase II schools. (Note that these were not the same schools where concerns and use data were collected.) A random sample of eleven schools was drawn including large, middle size and smaller schools. Two hundred seventy-nine classroom observations were made of ninety-two teachers and 3,114 district students. Sixty-seven percent of these teachers taught a single grade level and thirty-three percent of the teachers a multi-age class. Only ten percent of the teachers were science specialists who taught more than one group of students each day.

Interviews and classroom observations were conducted by specially trained certified teachers and by staff members from the evaluation and science departments. Data collection took place from February through April, 1978, in Phase I schools, and August through January, 1979, in Phase II schools. Each grade three through six teacher who taught science was interviewed extensively and observed for a total science class on three separate occasions. In addition, the principal and library media specialist for each school were interviewed. Complete description and detailed findings for the total study are found in the evaluation report (Darnell, 1979).

Figure 7. EXAMPLE OF A COMPONENT DESCRIBED

2 IS SCIENCE TAUGHT ACCORDING TO R-1 GUIDE ?

OUTSIDE INTENDED PROGRAM 1	GETTING A GOOD START 2 3	BEST PRACTICES WORKING 4 5
A During the school year the teacher covers less than 85% of the objectives and activities. The teacher may or may not cover units in the guide. If units are taught, more activities are omitted than included.	A During the school year 85% of the objectives and 85% of the activities are taught. The teacher covers the units as written and spends the allotted time (see #1). Some units may be abbreviated because an extra amount of time was spent on another unit.	A During the school year the teacher teaches all units, all objectives of each unit and 90% of the activities. At the end of some objectives teacher uses Optional Activities to extend the unit with small groups of students.
B Objectives or activities are not sequenced. Objectives may be used but teacher-made activities mainly are used to accomplish the objectives.	B The teacher can: - Point in the guide to the objective that is currently being taught. - Describe what objectives and activities went before and what objectives will come after current activities.	B The teacher can relate what objective is being studied and how the activity pertains to accomplishing the objective. He/she can relate what objectives preceded and will succeed the objective being taught.
C Supplementary media is frequently used in addition to or to the exclusion of hands-on activities.	C Teacher uses supplementary media sparingly.	C Teacher uses supplementary media sparingly and can demonstrate how supplements which are used support the objectives being taught.

Data were summarized for each teacher across interviews and observations. Each classroom was assessed on every component and a building summary was constructed. Figure 8 represents an example of a building summary sheet.

Presentation and discussion of findings. Figure 9 displays the average extent of implementation for all classrooms for each of the twelve components. In general, in the second year of the implementation effort the program appears to be "getting a good start."

The most successfully implemented components, as indicated by a very low percentage of teachers "outside intended program," were components 6, 7, and 8. There was general agreement by principals and program developers that these components had high priority. Principals realized their influence and monitored these components in their buildings on a regular basis. As an example (see Figure 10), in component 6, dealing with availability and organization of materials, none of the classrooms were outside the program, 52% were getting a good start, and 48% were approaching or had reached "best practices." Similar findings were noted for components 7 (Building Arrangements) and 8 (Long- and Short-range Planning) (see Darneli, 1979).

Looking further at specific components, other patterns emerge. On component 1 (Time is Devoted to Science, Figure 11), the data indicate that 44% of the classrooms received less than the school board recommended portion of the instructional day for science. Slightly over one-half of the classes, 56%, received the recommended allotment of time. Apparently, teachers do not consider science a major instructional concern in a district where basic skills are emphasized. Similarly, component 2 (Use of District Guide) indicated many teachers not teaching a significant portion of the new program, with 38% still "outside the intended program."

FIGURE 8

Sample Building Summary Sheet

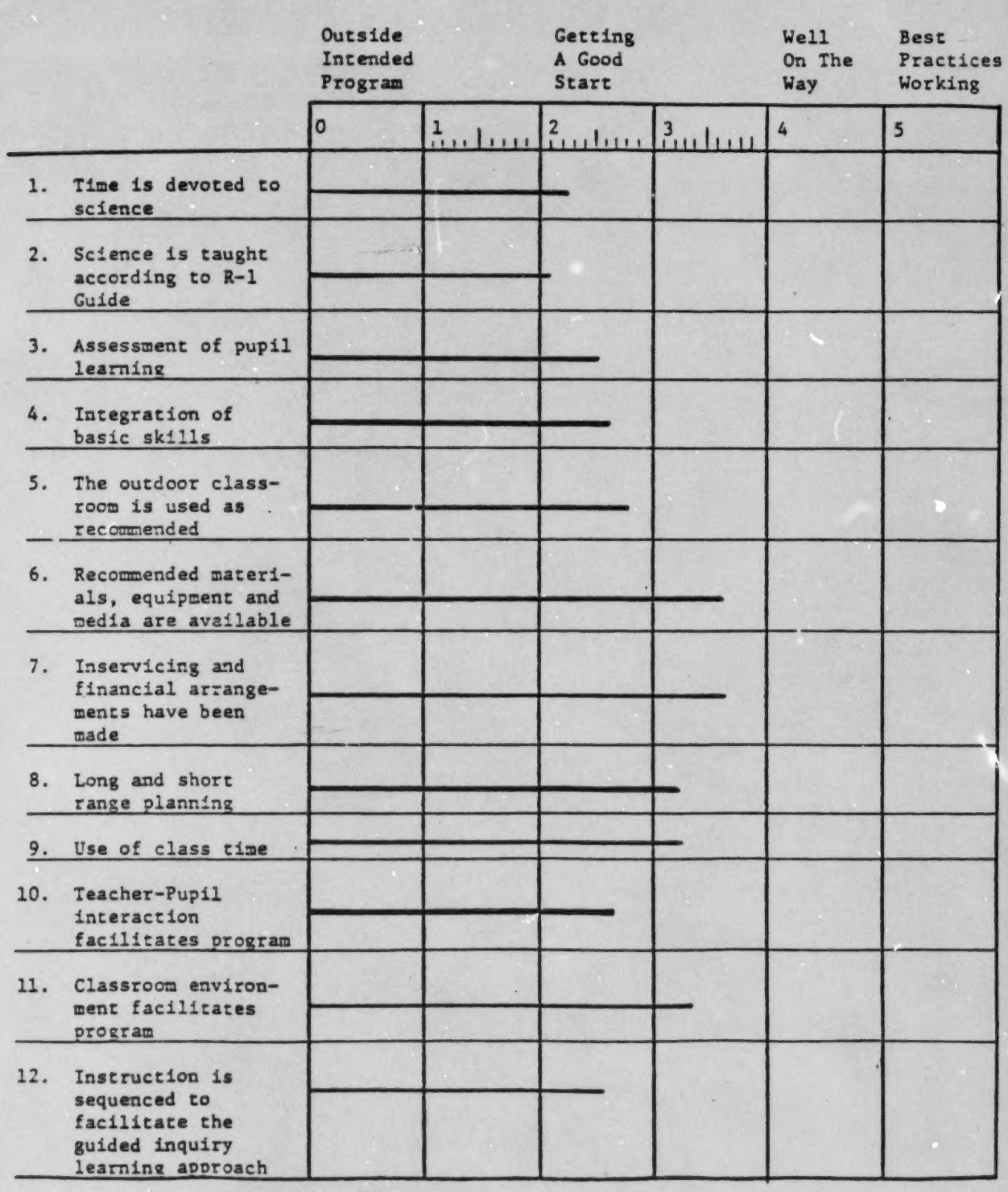
	OUTSIDE INTENDED PROGRAM	GETTING A GOOD START		WELL ON THE WAY	BEST PRACTICES WORKING
	1	2	3	4	5
1. Time is devoted to science	*** **	*	**	*	**
2. Science is taught according to R-1 Guide	*** ***	*** **			
3. Assessment of pupil learning	*** ***	*** **			
4. Integration of basic skills	*	***** ****	*		
5. The outdoor classroom is used as recommended		*** **	*** *	**	
6. Recommended materials, equipment and media are available			*** **	*** *	**
7. Inservicing and financial arrangements have been made		*	*** **	*** **	
8. Long and short range planning		***	*** ***	**	
9. Use of class time	**	**	****	**	*
10. Teacher-Pupil interaction facilitates program	***	****	****		
11. Classroom environment facilitates program		***	***	***	**
12. Instruction is sequenced to facilitate the guided inquiry learning approach	**	**** *	****		

School Winter Elementary Teacher all 3, 4, 5, 6 teachers

R-1 Program Evaluation
Revised Elementary Science Program Evaluation.1/80

Figure 9

The Average Extent of Implementation on Each Component for All Classrooms

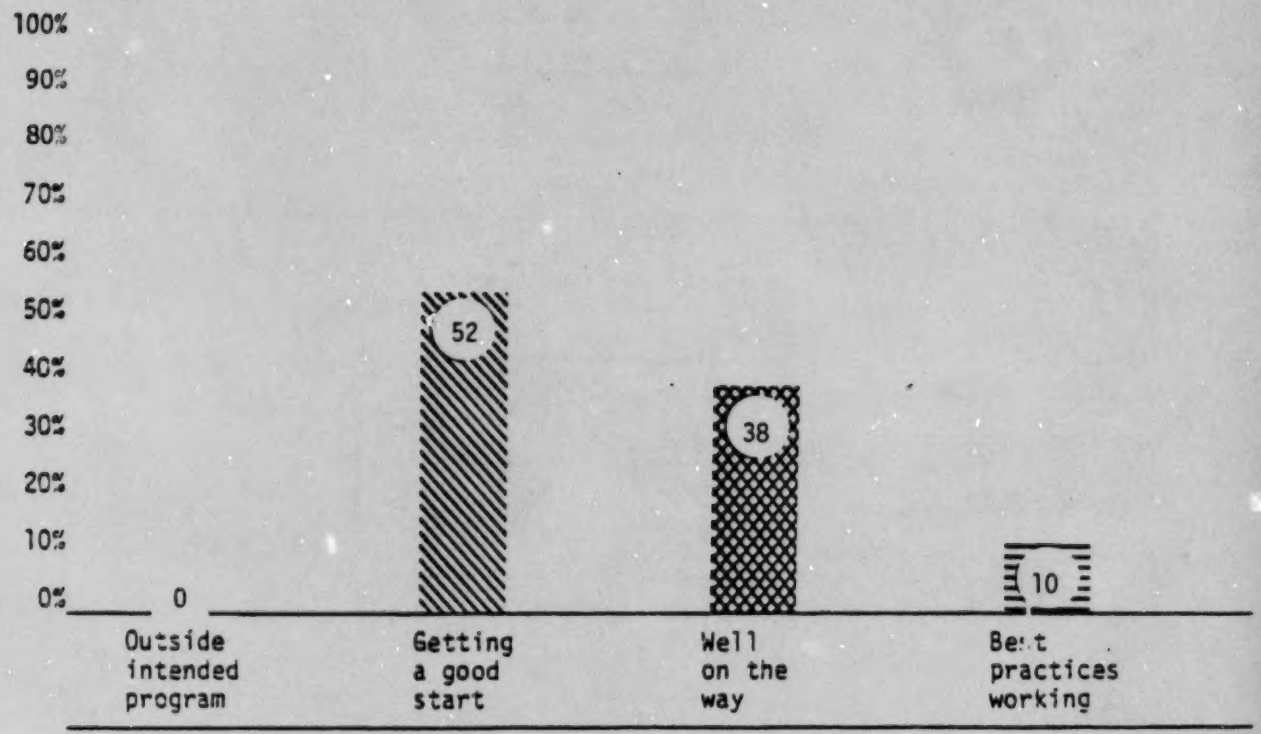

Outside Intended Program
Getting A Good Start
Well On The Way
Best Practices Working
0
1
2
3
4
5
1. Time is devoted to science
2. Science is taught according to R-1 Guide
3. Assessment of pupil learning
4. Integration of basic skills
5. The outdoor classroom is used as recommended
6. Recommended materials, equipment and media are available
7. Inservicing and financial arrangements have been made
8. Long and short range planning
9. Use of class time
10. Teacher-Pupil interaction facilitates program
11. Classroom environment facilitates program
12. Instruction is sequenced to facilitate the guided inquiry learning approach

N = 113

FIGURE 10

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #6 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #6. RECOMMENDED MATERIALS, EQUIPMENT AND MEDIA ARE AVAILABLE AND ORGANIZED FOR SMOOTH IMPLEMENTATION.

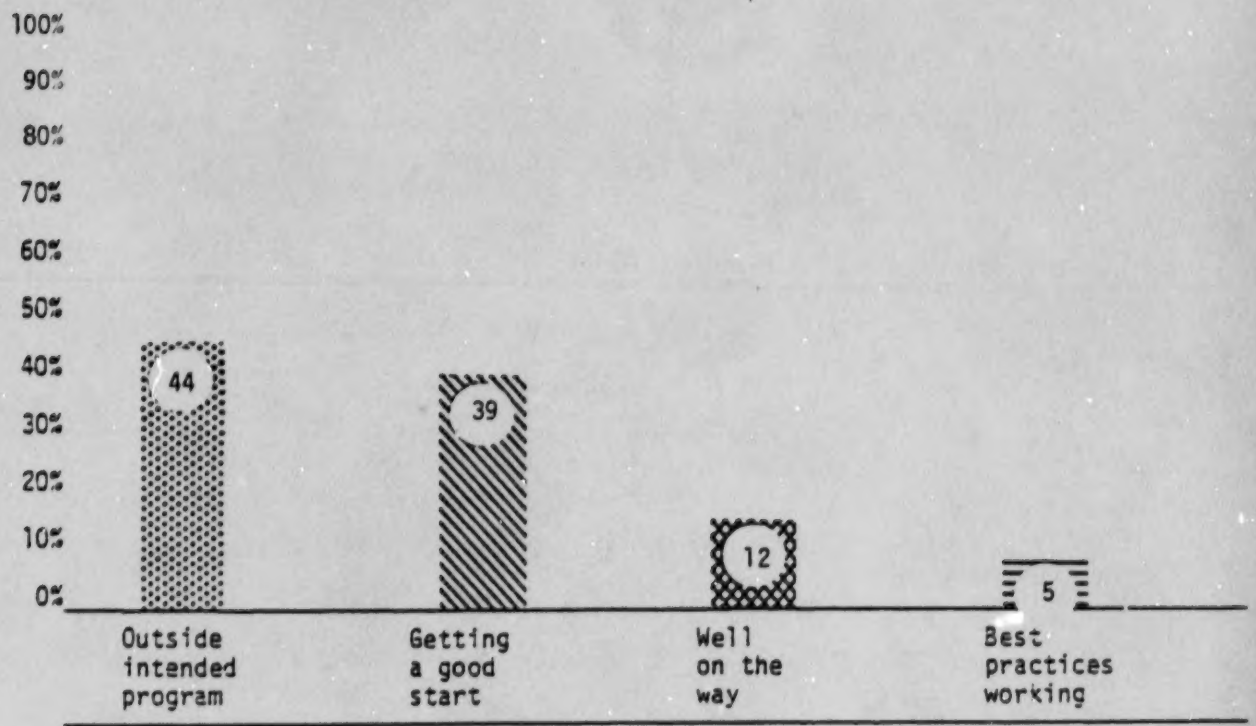


	Outside intended program	Getting a good start	Well on the way	Best practices working
CRITERIA	. Current commercial guides unavailable to teachers. . Materials & equipment not available at right time. . Haphazard storage system.	. Current commercial guides and R-1 Guide must be shared. . Teacher aware of plan for making all materials available. . Some storage organization, but not operating smoothly yet.		. All science teachers have commercial and R-1 Guides. . Adequate materials for groups of 3-5 students. . Storage system working smoothly.

FIGURE 11

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #1 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #1. TIME IS DEVOTED TO TEACHING SCIENCE



CRITERIA

Outside intended program	Getting a good start	Well on the way	Best practices working
• Anything less than an average of 12% of the instruction day used for science instruction for grades 4, 5, and 6. • Anything less than an average of 8% of the instruction day used for science instruction for third grade.	• An average of 12% or more of the instruction day is used for science instruction in grades 4, 5, and 6. • An average of 8% or more of the instruction day is used for science instruction in third grade.	• An average of 15% the pupil instructi day is devoted to science for grades 4, 5 and 6. • An average of 10% o the pupil instructi day is devoted to science for third grade.	

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"Time on Task," captured in component 9, is discussed in recent literature as a good predictor of student achievement. With so little time each day devoted to science it was important that teachers use it to advantage for students. Figure 12 shows that more than 90% satisfied the minimum criteria and 41% of these were "well on the way" and into "best practices working." It appears that in classrooms little time is spent on materials set-up and clean-up, discipline and teacher lectures. Time is spent on students working with materials individually or in small groups, and in teacher/student discussion.

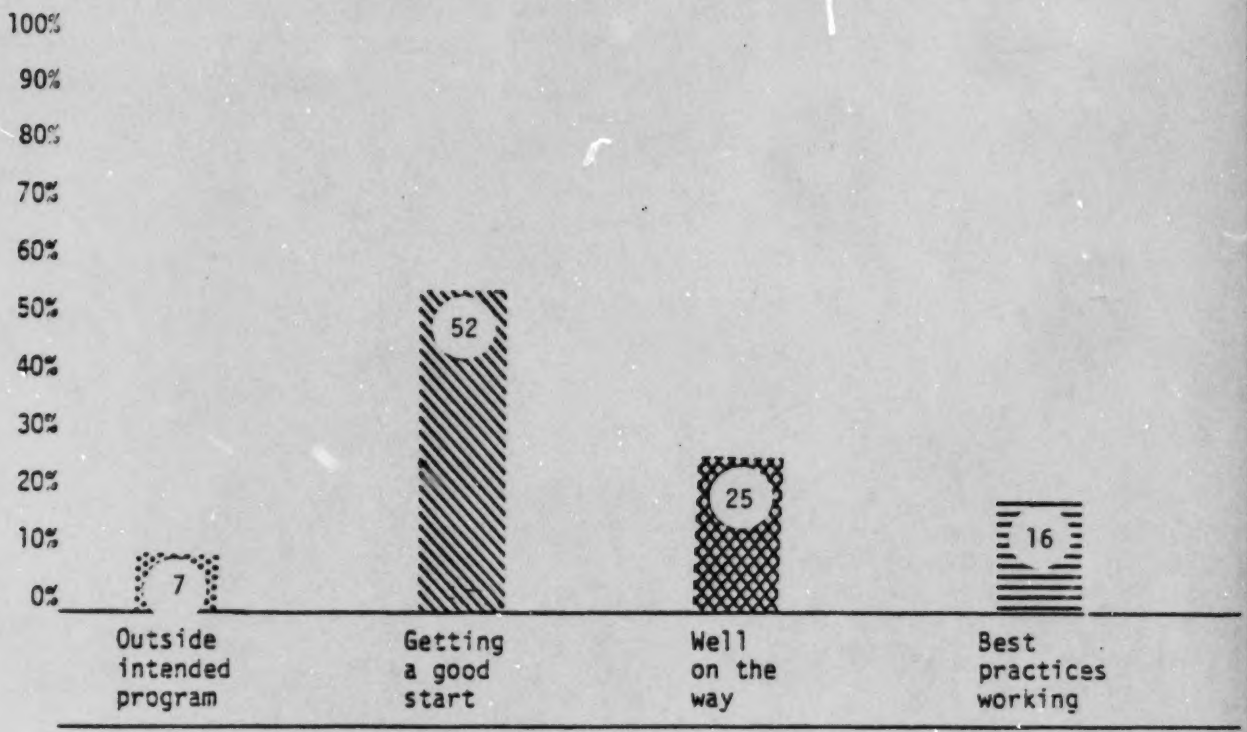
Of the components over which teachers have total control, component 11, "Classrom Environment and Grouping Facilitate the Program Implementation," was the most successfully implemented. It is probably one of the least difficult of the components to put in place, since it deals with the actual physical arrangement of the classroom which enables students to work with "hands-on" and "student-to-student interaction" activities. As displayed in Figure 13, 48% of the teachers were into or approaching the best practices category, with 36% of them getting a good start. The inservice training period for teachers stressed these management techniques, and, as a result, classroom implementation appears to be occurring.

Component 10, "Teacher/Student Interaction Facilitates Implementation," is considered critical to the eventual success of the program for students. The inquiry learning approach upon which the program is based requires from teachers a high level of skills in facilitating experimentation and discussion. Most teachers need a great deal of training and practice in these skills to feel comfortable in their use. Figure 14 shows data to indicate that more than half the teachers observed were demonstrating these skills in a minimal way. The skills were implemented in the consistent "well on the way" manner in only 20% of the classrooms. A very few (1%) exemplary models existed.

FIGURE 12

PERCENT OF IMPLEMENTATION OF THE REVISED SCIENCE PROGRAM
FOR COMPONENT #9 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #9. CLASS TIME IS USED EFFICIENTLY AND EFFECTIVELY (time on task)



	Outside intended program	Getting a good start	Well on the way	Best practices working
CRITERIA	• More than 40% of class time used for discipline and/or clean up.	• Approximately 60% of class time used for - exploration - pupil interaction - recording data - discussions - listening to each other. • The rest for organization and control, getting ready and clean up.		• At least 75% of the class time is devoted to - exploration - pupil interaction - recording data - discussions - listening to each other. • The rest for organization and control, getting ready and clean up.

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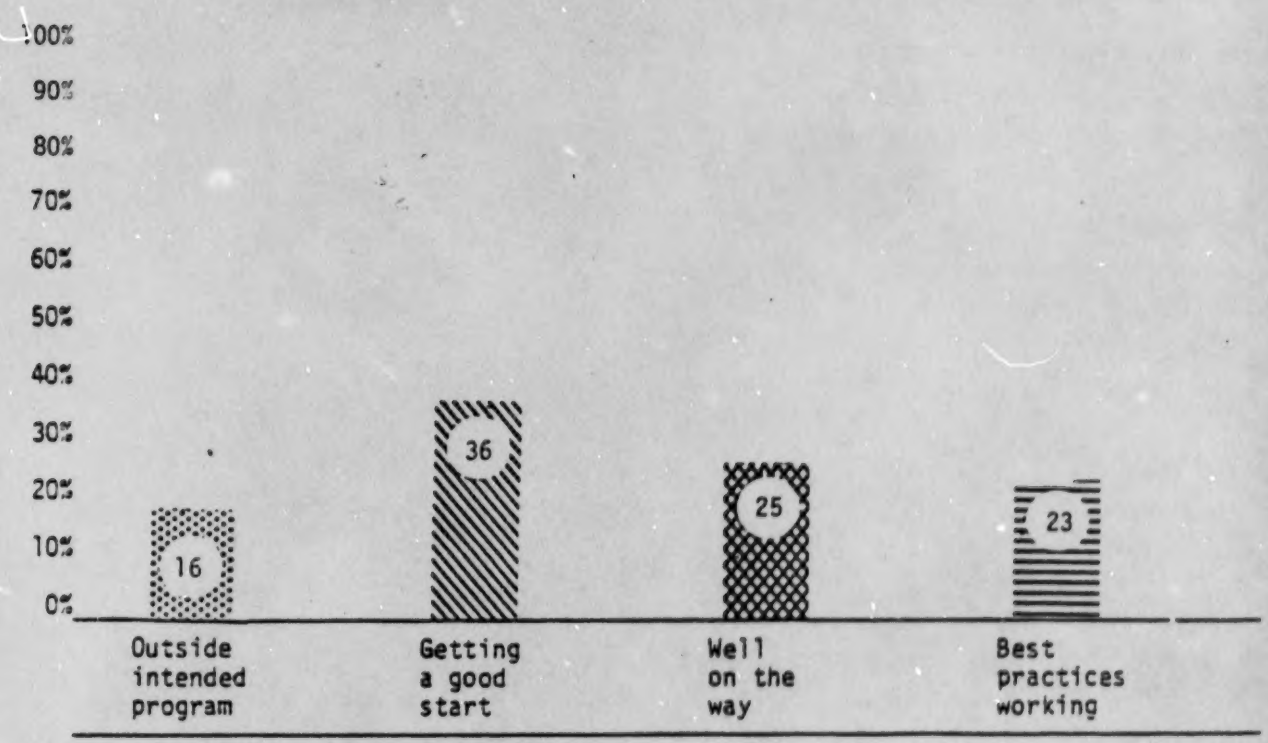
FIGURE 13

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #11 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #11. CLASSROOM ENVIRONMENT AND GROUPING FACILITATE PROGRAM IMPLEMENTATION.

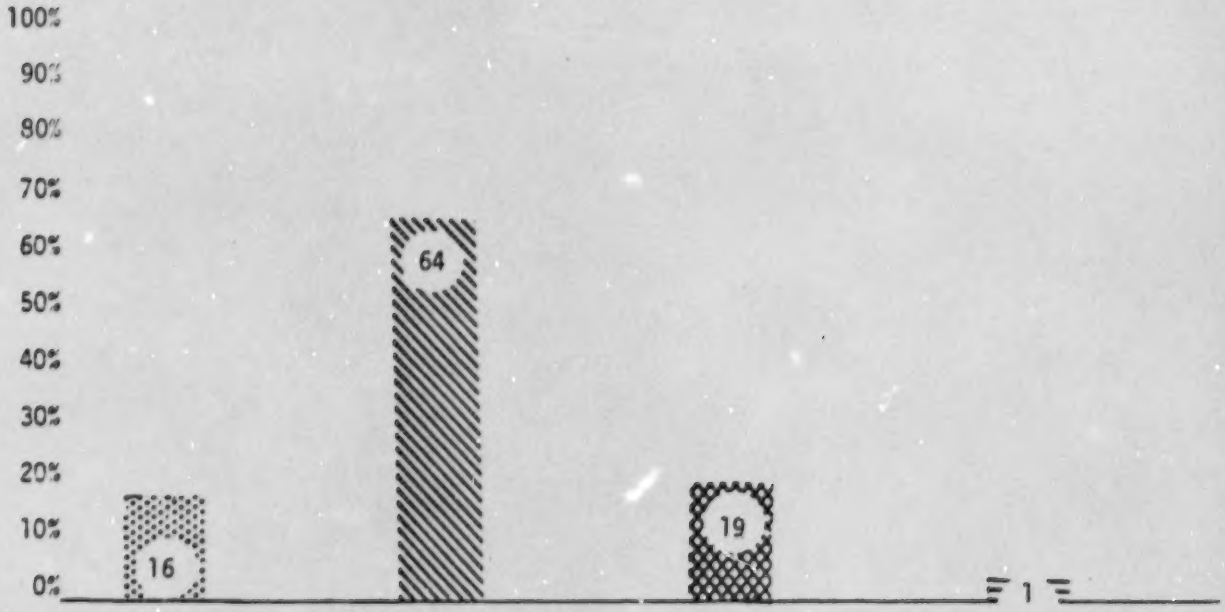


CRITERIA	. Desks in rows. . Activities directed to individuals . Teacher dominates. . Students usually not task oriented	. Approaching "Best Practices." . Materials organized for small groups. . Cooperative learning infrequent. . Students task oriented most of time.	. Desks arranged for small group interaction. . Materials organized for small groups. . Cooperative learning is expected. . Students are task oriented.

FIGURE 14

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #11 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #10. TEACHER-PUPIL INTERACTION FACILITATES IMPLEMENTATION OF INTENDED PROGRAM.



	Outside intended program	Getting a good start	Well on the way	Best practices working
CRITERIA	• Objectives not shared with students. • No discussions dealing with concept formation are held. • Teacher lectures and asks "fill in the blank" questions. • "Rap session" discussions dominate to the exclusion of activity based learning.	• Objectives shared with students. • Discussions are limited to data sharing. Occasional concept discussions. • Some good discussion techniques are used. • Some questions above the recall level and open ended.	• Objectives shared with students in their language. • Discussion is an integral part of learning cycle. • Discussion techniques include: large/small groups used appropriately, wait-time--neutral reward, divergent questions, "basketball" discussion, etc.	

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Implications

Summary of Major Insights

Several insights may be derived from the data gathered around the Jeffco science implementation effort. From the concerns and Levels of Use data, it appears that:

1. A change effort that successfully achieves curriculum implementation can be launched across a large school district. In this particular case a "concerns-based" design was effectively utilized, delivering training, assistance and support targeted at different kinds of concerns as they emerged.

2. Successful implementation requires a significant time investment. It took three years before most of the teachers reached at least a Routine Level of Use.

3. The time it takes to successfully implement a program appears to vary with such influences as teacher experience with change facilitator expertise, and grade level mobility. See other papers for identification of other important variables (Hall, Hord & Griffin, 1980; Loucks & Hall, 1979).

Additional insights may be gained from data gathered about specific program components:

1. It is possible to operationally define a program in terms of its component parts, and to derive a measure of implementation using these components.

2. In the second year of the implementation effo.., it appears that the teachers utilizing the program were "getting a good start" with all the components.

3. The most successfully implemented components were those to which building principals contributed (#6, 7, 8). The least successfully implemented were those mandated by the district, or those most likely to lack ownership by principals and teachers (#1, 2). Teachers also have success implementing components over which tney have complete control and which are management-oriented (#9). They have less success with components requiring orientation to student learning/tninking needs (#10).

Discussion

On the surface, this paper may appear to report two distinct and different studies, similar only in that they focused on implementation of a particular curriculum. However, critical understandings have resulted from the use of three methodologies assessing the impact of the same series of events, and from

the actual process of researcher/practitioner collaboration in facilitating and monitoring a change. These understandings are discussed below:

1. Each different data set had its unique usefulness. Early in the change effort, Stages of Concern enabled specific overview sessions and training workshops to be planned that were targeted directly at answering the questions teachers were asking. Content was adjusted and specific interventions were made based specifically on SoC profile information. Level of Use data were more valuable as a yardstick for assessing regularly how teachers were progressing in their implementation. Was use occurring? If so, with what degree of "mastery?" On the other hand, as initial implementation occurred, district staff needed much more specific information about what teachers were actually doing in their classrooms. Thus, the components were developed not only to assess aspects of the curriculum, but to monitor whether the requirements for implementation (e.g., planning time, equipment) were readily available. The component assessment system became a means to feed back teacher data to principals, in order to assist them in supporting teachers to implement district curriculum (efferson County Schools, 1979). Thus, each of the three concepts and their accompanying methodologies had a unique use.

2. The different data sets provide some hints of correlating with each other. Ideally, all three kinds of data should have been collected from the same teachers. This was not done, largely to avoid respondent overload. However, similar trends emerge. Although it is possible to conceive of teachers at any Level of Use implementing components to different extents, it might be hypothesized that teachers with "best practices working," i.e., with highest extents of component implementation, might be at higher Levels of Use. There were some data to support this. Overall, in the second year of implementation, teachers were at a Mechanical Level of Use, and component assessment indicated

they were "getting a good start." One can only guess whether levels higher than Mechanical correlate with higher component scores. This remains for future data collection and analysis.

In addition, it is interesting to note which components appear to have been implemented to the greatest extent: they are those dealing with management of materials, time and students. These are the focus of management-concerned teachers, those at a Mechanical Level of Use. Those components implemented to a lesser extent are those that focus on more subtle student learning needs, and on a commitment to make science a significant learning experience in the student's schooling. These are the focus of impact-concerned teachers, those at Refinement Level of Use and above. Few of these teachers existed in the sample.

3. When is implementation accomplished? That is the question! Four years ago when the collaborative effort began, a large task loomed: to implement a curriculum in 80 elementary schools in a large, diverse district. Goals were set, and four years later have been accomplished. No small accomplishment. Now, the past work appears to have been the easy part. Teachers use the curriculum across the district routinely--they have no very intense concerns. That's good in some ways, but it also means that few of them are concerned about how students learn, how to stimulate inquiry, and how to analyze their own teaching to improve its effect on students. How does one arouse impact-oriented concerns, and once aroused, what interventions are most appropriate to assist teachers in improving student learning? The district has begun piloting some ideas to meet these needs, but such interventions are often labor intensive, costly, and require building-level commitment to provide critical teacher support. The participation of the building principal is required, but adding a facilitator's hat to all of those the principal already wears is no easy undertaking. Acknowledging that principals also have concerns, and that these

need to be taken into account if any change effort is to succeed, is an important insight derived from this effort. A Pandora's box has been opened, and a formidable challenge in understanding how to assist both teachers and principals in the undertaking of school improvement lies ahead.

4. What is this beast called "collaboration?" Papers, articles, books are written on the subject. The lack of either "useful" research or research being put to practical use underlies the need for more cooperative efforts between researchers and practitioners. Four years of Jeffco/UTR&D collaboration have resulted in the development of strong professional and personal relationships. It's impossible and unnecessary to say who has done what, whose results are whose. We know we all have benefited.

Perhaps the CBAM can help us reflect on how successful collaborative relationships develop over time. Truisms like "trust-building" and "shared decision-making" don't capture what really happens. Rather, we all started with Informational and especially high Personal concerns. "How does a large school distric function?" "What exactly is research?" "Can I be relevant to school people?" "Will I need to remember my statistics?" "They just don't understand The Model!" "They're writing down all the mistakes I'm making!" "You're telling me what to do in one of my schools?" Management concerns followed (although Personal concerns never completely disappeared). "Why don't we ever get the data soon enough?" "Why don't all the schools expect us when we arrive to collect data? In any collaborative effort it is critically important to acknowledge these emerging concerns and deal with them as legitimate. Hopefully, this sensitivity allowed us to proceed and contribute some understandings about school change.

Maybe it's the result of aging, or just living through it, but impact concerns are dominant now. Why else spend time in a Copper Mountain ski lodge

writing an AERA paper, when everyone else is skiing? Why live out of a suitcase more than we'd like to so that we can share with other school people, researchers and evaluators what we've learned and how they can help us learn more?

One sign of good research is that it stimulates more questions than it answers. It is our hope that the Jeffco/R&D Center collaboration will be a building block to more and better efforts to focus practitioners and researchers on critical factors and processes that affect the improvement of schools.

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IMPLEMENTATION AT THE SCHOOL BUILDING LEVEL: THE DEVELOPMENT AND ANALYSIS OF NINE MINI-CASE STUDIES

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Spring 1980

Paper presented at the annual meeting of the
American Educational Research Association,
Boston, April, 1980

IMPLEMENTATION AT THE SCHOOL BUILDING LEVEL: THE DEVELOPMENT AND ANALYSIS OF NINE MINI-CASE STUDIES[1, 2]

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For the last ten years there have been pessimistic declarations that change is not occurring at the classroom level. Such laments from observers of school improvement are frequently supported with expert testimony and in-depth case studies of failures. In contrast, this paper, a synthesis of nine "mini-case studies," reports on varying degrees of successful school change. A set of hypotheses about the factors that appear to be related to change at the classroom level are proposed. The hypotheses suggested are grounded in both qualitative and quantitative data.

Studies of change in schools usually take one of two perspectives: explore one campus and study it in-depth, or examine a large sample across many

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[1]This paper is based on a set of inhouse papers developed by staff of the Research on Concerns-Based Adoption Project, Research and Development Center for Teacher Education, The University of Texas at Austin: Gail Brown, Teresa Griffin, Gene Hall, Shirley Hord, Susan Loucks, Nettie Miller, Beulah Newlove, Bill Rutnerford, and Pat Zigarmi. Special recognition is given Linda Simons, who gathered the ethnographic data for the study, and whose thoroughness and persistence are greatly appreciated. Special thanks are also given to our colleagues in Jefferson County, Marge Melle, James Metzdorf, and Harold Pratt, who participated in the development of many of the ideas presented in this paper.

[2]The research described herein was conducted under contract with the National Institute of Education. The opinions expressed are those of the authors and do not reflect the position or policy of the National Institute of Education, and no endorsement by the National Institute of Education should be inferred.

districts with limited depth at each site. By contrast, the observations and hypotheses reported in this paper derive from a multiple-school sample studied over an extended period of time as part of an intensive three-year study of change. In addition, while a wide-ranging set of variables was explored in each building, the nine schools are a subset of elementary schools in one large suburban district, thereby providing control over district context variables. Since this district has a long standing policy of district-wide curriculum, the implementation "game plan" was the same for all of the district's 80 elementary schools.

As a part of a district-wide longitudinal study of an elementary science curriculum implementation, nine schools were selected to be the foci of nine mini- case studies. The objective of the case studies was to examine across-building differences and within-school influences on implementation of the innovation by individual teachers. The objective of this paper is to report on the school-specific data and to synthesize across the nine case studies. Using an open-ended style, hypotheses are developed about the factors that influenced individual teacher change in relation to the new curriculum. The case studies and hypotheses are being used in the planning of a set of two-year studies of the influence of building principals on teacher change.

CASE STUDY METHODOLOGY

Beginning in 1976, researchers at the R&D Center for Teacher Education at The University of Texas at Austin and the staff developers and science curriculum coordinators in Jefferson County School District, Colorado, collaborated in an effort to apply the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973) to the implementation of a district-wide revision of the science

program for grades 3-6. During this period of collaboration, qualitative and quantitative methodologies were used to document various aspects of the change process.

Both types of methodologies were used in the belief that qualitative data integrated with quantitative data could produce more powerful insights about the change process than either could have produced alone (Sieber, 1973). Data collected over the three-year period have been analyzed and reported in several ways. The overall game plan for the change effort has been described by Loucks and Pratt (1979) and Pratt, Melle, Metzdorf & Loucks (1980). Several papers have been developed which focus on the district-wide effects of implementation (Loucks & Hall, 1979; Loucks & Melle, 1980; Pratt, Winters & George, 1980). Other papers have linked the quantitative data to the intervention game plan (Hall & Loucks, 1978).

The Concepts and Their Measurement

The Concerns-Based Adoption Model (CBAM) was developed as a means to understand and describe innovation adoption and implementation. The CBAM assumes that change is a process accomplished by individuals. The CBAM makes it possible to pay particular attention to two aspects of the individual's developmental growth in relation to the innovation. These two dimensions are Stages of Concern About the Innovation (Hall & Rutherford, 1976) and Levels of Use of the Innovation (Hall, Loucks, Rutherford & Newlove, 1975).

Seven Stages of Concern (SoC) have been defined to describe the feelings individuals experience in regard to the innovation. These range from concerns about how the innovation will affect them personally, to concerns about how to complete the tasks related to using the innovation and finally to concerns about

the impact of the innovation on clients or pupils. The seven Stages of Concern are defined in Appendix A.

For research purposes, Stages of Concern are measured using the thirty-five item SoC Questionnaire. The raw data from the SoC Questionnaire are converted to relative intensity scores by use of scale specific percentile tables. Concerns profiles are then constructed which graphically display the intensity of all Stages of Concern for the respondent(s). Procedures for clinical interpretation of these profiles have been established (Hall, George & Rutherford, 1977).

Eight Levels of Use (LoU) have been identified that describe the behaviors of individuals during implementation. An individual begins with Nonuse of the innovation, then moves to Orientation about the innovation, and Preparation for first use. Initial use is usually Mechanical, but as experience with the innovation increases, users can move into a Routine pattern of use. Individuals then may Refine their use of the innovation, Integrate their refinements with those of their colleagues, or Renew their use, based on assessments of the impact of the innovation on clients or students. The definitions of each Level of Use are presented in Appendix B.

LoU is assessed using a focused interview procedure (Loucks, Newlove & Hall, 1975). A trained interviewer conducts a ten to thirty minute interview with each nonuser or user. The LoU interviewer uses a branching technique based on the operational definition of LoU and follow-up probes to obtain information about what the teacher is doing. An overall Level of Use rating can then be assigned to each person interviewed.

A third concept, Innovation Configurations (IC) (Hall & Loucks, 1978), has been developed to describe and measure the various operational forms of the innovation that result as individuals adapt it for use in their particular situa-

tion. Using this concept, the components of an innovation are identified, and an individual user's Innovation Configuration can be described. An Innovation Configuration is determined by identifying the components a user selects, the variations within the components and the organization of the components.

The Data Base

Several sources of data were used by CBAM staff in developing the nine case studies. The quantitative data included regular assessments of teachers' Stages of Concern About the Innovation (SoC) and their Level of Use of the Innovation (LoU). Innovation Configurations (IC) were also assessed although not as rigorously, since this concept was under development at the time. SoC and LoU data were collected on five occasions as the change process unfolded (fall 1976; spring 1977; fall 1977; spring 1978; spring 1979). Innovation Configurations were assessed at these same schools on two occasions (spring 1977 and spring 1979).

The qualitative data documented what was done by district staff developers and science department staff to facilitate implementation of the innovation, the Revised Science Program. Forty-one volumes of ethnographic reports were compiled by a full-time ethnographer who was located on-site during the first two years of the implementation effort. These protocols include descriptions of the activities of district administrators, staff development and science department staff, and teacher leaders and science teachers participating in the implementation. In addition, several of the Jefferson County district staff kept records of their activities as "participant observers." CBAM staff kept notes of their observations about the implementation when they were on-site for collaborative planning purposes and/or collection of quantitative data. District memoranda and documents related to the science implementation effort were also a part of the qualitative data base.

Development of the "Mini" Case Studies[3]

The mini case studies were developed as part of the advance work for a new study of the change process. In writing their case studies, staff were asked to focus on several conceptual and methodological issues. The conceptual focus was on identifying building level influences that were related to change or lack of change in teachers' SoC, LoU, and IC. In particular, through the case studies, hypotheses were to be developed about the relationship between principal behavior and users' SoC, LoU, and IC. In addition, as several different data collection methodologies were used in this study, development of the case studies provided an opportunity to assess the specific usefulness of each. The immediate use of the case study effort would be to influence decisions about data collection procedures and variables to be observed in the upcoming study of principals.

REVIEW OF THE IMPLEMENTATION GAME PLAN

To allow the Science Department staff to focus their efforts on one-third of the total number of schools at a time, the overall plan for implementing the innovation called for introducing it (the Revised Science Program) across the district by phases at roughly six-month intervals. The 80 elementary schools in the district were assigned by administrative area to one of three phases (Phase I, II, or III). Inservice activities for each phase began with an orientation

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[3]The term "mini" was deliberately chosen for this work. The case studies are based on imperfect data bases and in many ways represent secondary analyses of the major district-wide study. These case studies were also intended from the outset to be short in length. The objective was to use the data and case study development activity as a heuristic mechanism rather than simply creating more in-depth tomes about change in one school.

for administrators, where school principals learned about the equipment and supplies needed for the Revised Science Program, about ordering and scheduling procedures, and other details about the management of the innovation. They also heard suggestions for how to be supportive of their teachers during the change effort.

Teacher exposure to the innovation started with a brief after school "pre-inservice" session aimed at creating awareness of the new science program. Two months later the inservice began; three separate full-day released-time sessions were developed for each grade level, spaced over time in order to address management concerns about each science unit as that unit was being taught. Teachers were brought together by grade level to participate in the same activites that they would be using with students, to learn some management techniques, and to become familiar with the day-to-day use of the program. The inservice leader-to-teacher ratio was kept small by using classroom teachers, who had already taught the curriculum, as trainers.

Between inservice workshops two members of the Science Department staff visited schools for "comfort and caring" activities, such as talking with teachers about issues or observing science classes to help teachers deal with problems. When called upon, the Science Department staff also provided other types of assistance, from cleaning and organizing school science storage areas to rearranging teaching schedules and unit plans so science teaching could run more smoothly (Pratt, Melle, Metzdorf, & Loucks, 1980).

The same basic game plan for implementing the innovation was used for all three phases. The same district personnel and resources were available. The Texas R&D Center's CBAM staff continued to work as collaborative partners in the design of the concerns-based game plan and continued to collect quantitative and qualitative data in a representative sample of schools.

BUILDING LEVEL INFLUENCES ON CHANGE

This change effort provided a unique opportunity for exploring building level influences on change. Selected for case studies were nine schools, which were judged to be representative of the three phases and for which the most extensive data were available. The size of the schools selected ranged from one with 428 students and 17 teachers to one with 930 students and 39 teachers. Two of the nine schools had female principals. During the summer of 1979 each case study author developed a 15 to 25 page report of the data and their interpretations. These drafts were shared with field site colleagues for critiquing and checking for factual accuracy. In October, a two-day debriefing meeting was held involving CBAM and Jeffco staffs. At this meeting one point of consensus was that several of the case studies contained data and interpretations too sensitive to be placed in general circulation. In addition there was general consensus about key factors that had been nominated, interpretations which were made, and hypotheses that had been generated.

The authors of this paper are responsible for describing and synthesizing these findings. The differences between the schools are presented as well as hypotheses that appear to hold across schools. To develop the across-site generalizations, excerpts from the nine case studies are presented and SoC and LoU data are cited. Within the text, SoC and LoU data are aggregated to describe types of schools and to illustrate hypotheses.

Across School Comparisons

One of the first tasks was the examination of the Stages of Concern and Levels of Use data for each school and the identification of similarities and differences. The authors were looking for indications of institutionalization[4], unusual movement or non-movement in concerns profiles, or any other

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[4]From a CBAM perspective institutionalization is defined as having all users: a) at LoU IVA Routine use, or higher, b) with Stage 1, 2, and 3 concerns low and c) using acceptable innovation configurations.

patterns that might be illuminating. The school by school data were clearly different in some ways and surprisingly similar in other ways.

As an example, the Levels of Use distributions were quite similar. Teachers in all schools moved from nonuse (LoU 0, I and II) to use (LoU III-VI). Over time the proportion of teachers at LoU III Mechanical Use decreased and the proportion of LoU IVA Routine users increased. In general, few teachers were observed to be at the higher LoU's.

The SoC data provided more distinction between schools. In the Fall of '76 teachers in all schools generally had typical nonuser concerns profiles. Their most intense concerns were on Stage 0 Awareness, 1 Informational and 2 Personal. Their impact concerns (Stages 4, 5, and 6) were relatively low. As use began, the SoC profiles looked like those typical of users, but with interesting differences. Some schools maintained high Stage 3 Management concerns, other schools shifted with time to indications of Stage 4 Consequence concerns, while the group profile for other schools remained relatively flat.

The one common feature of the SoC profiles was the constantly high Stage 0 Awareness score. This stage is interpreted differently for users than it is for nonusers. For nonusers a high Stage 0 score is an indication of awareness of the innovation. In contrast, high Stage 0 score for users indicates that the innovation is not of high priority for the respondents, in comparison to other things in their lives. It appears then that for most of the teachers in these schools, implementation of the Revised Science Curriculum was not an overwhelming event.

In an attempt to better understand why teachers in some schools continued to have high Management concerns while teachers in other schools shifted to high Stage 4 Consequence concerns, the schools were grouped by concerns profile. The nine schools were placed in one of three groups based on their overall SoC profile for the last data collection period. (For eight of the nine schools the

last data collection was in the Spring of 1979, for one this was the Spring of 1978.)

One group contained schools (#1, 2, and 3) that continued to have high Management concerns. A second group was Mixed (Schools 4, 5, 6 and 7), the SoC profiles having no sharp high or low concerns stages. There were some indications of Impact concerns, but Management concerns were also indicated. The third group of schools (#8 and 9) had concerns profiles with high Impact concerns (Stages 4, 5, or 6); Management concerns (Stage 3) were low. The rank ordering of highest stages of concern for each school is summarized in Table 1. The SoC profiles and LoU data by school for the last data collection period are presented in Figures 1, 2, and 3. The data displays indicate that Stages of Concern are useful in discriminating between schools.

Table 1

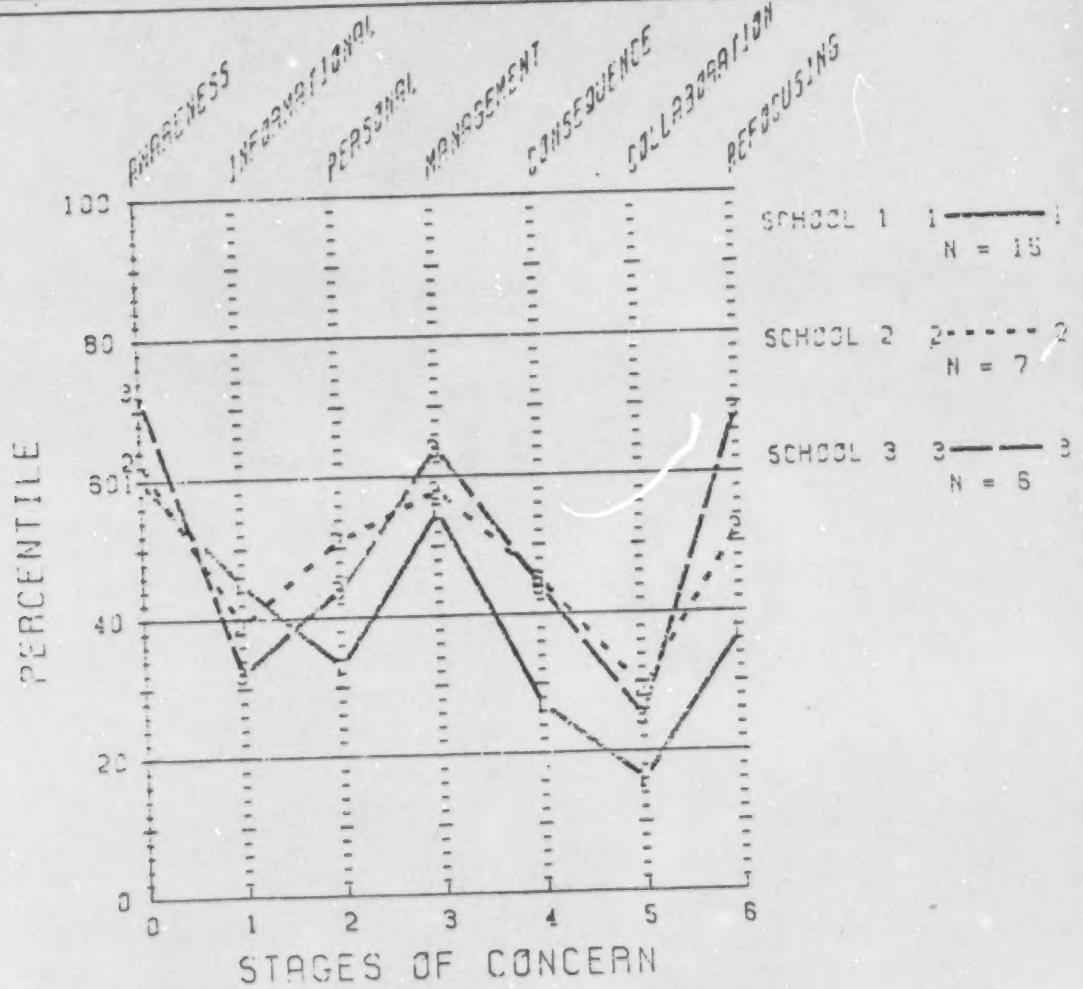
Rank Order of Intensity of Stages of Concern for School SoC Profiles

Group 1 Management	HIGH	SECOND	THIRD	FOURTH	INSERVICE PHASE
School 1:	0	3	6	2	I
School 2:	0	3	6	2	III
School 3:	0	6	3	2,4	I
Group 2 Mixed					
School 4:	0	3	2,4	1	I
School 5:	0	3	4	2	III
School 6:	0	6	3,4	2	I
School 7:	0	1	4	2	III
Group 3 Impact					
School 8:	4	0	6	5	III
School 9:	0	6	4	5	II

Once the school groupings were identified, the case studies were searched for indications of commonalities within groupings and differences between

Figure 1

MANAGEMENT SCHOOLS
FINAL DATA COLLECTION



LEVELS OF USE DISTRIBUTION

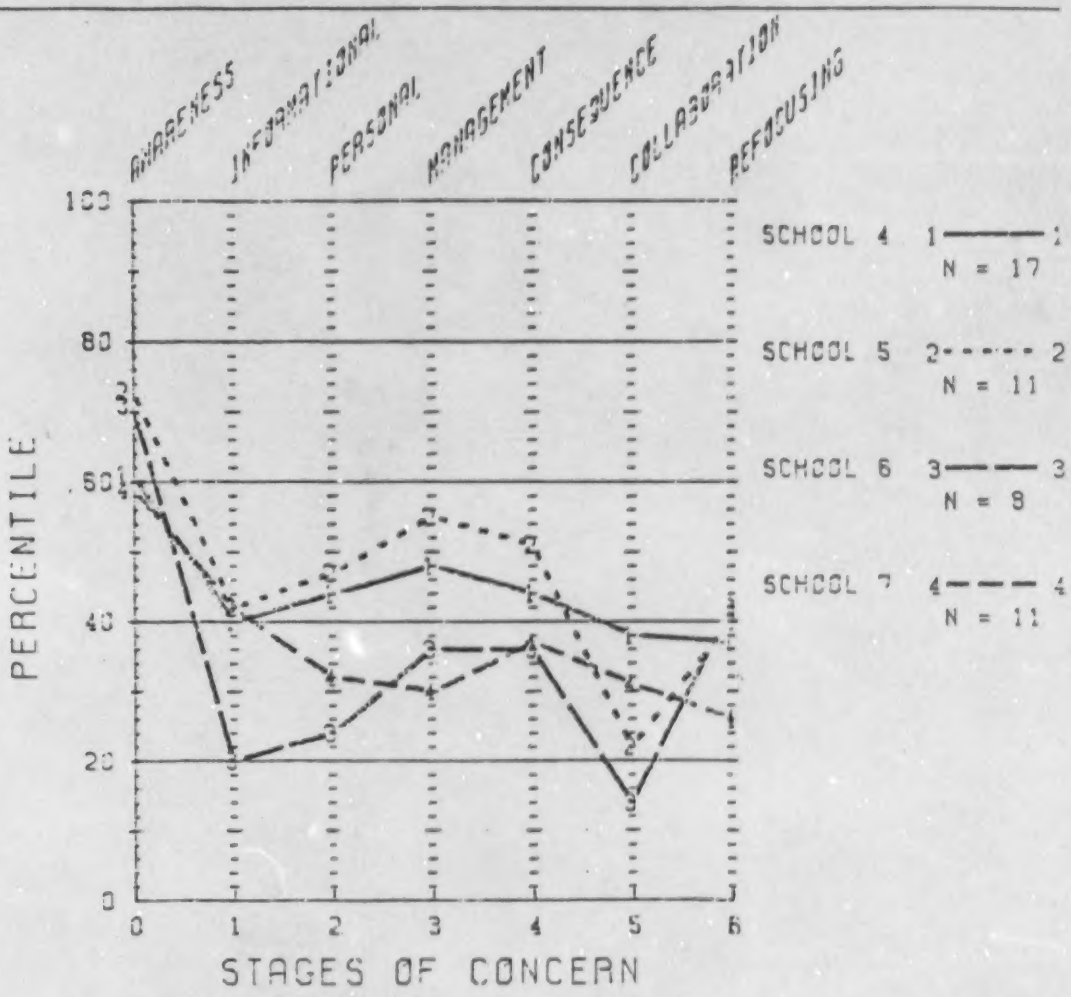
	0	I	II	III	IVA	IVB	V	VI	
SCHOOL 1	0	6	6	46	33	6	0	0	N = 15
SCHOOL 2	0	0	0	57	14	28	0	0	N = 7
SCHOOL 3	12	0	0	25	62	0	0	0	N = 8

PERCENT AT EACH LOU

BEST COPY AVAILABLE

Figure 2

MIXED SCHOOLS
FINAL DATA COLLECTION



LEVELS OF USE DISTRIBUTION

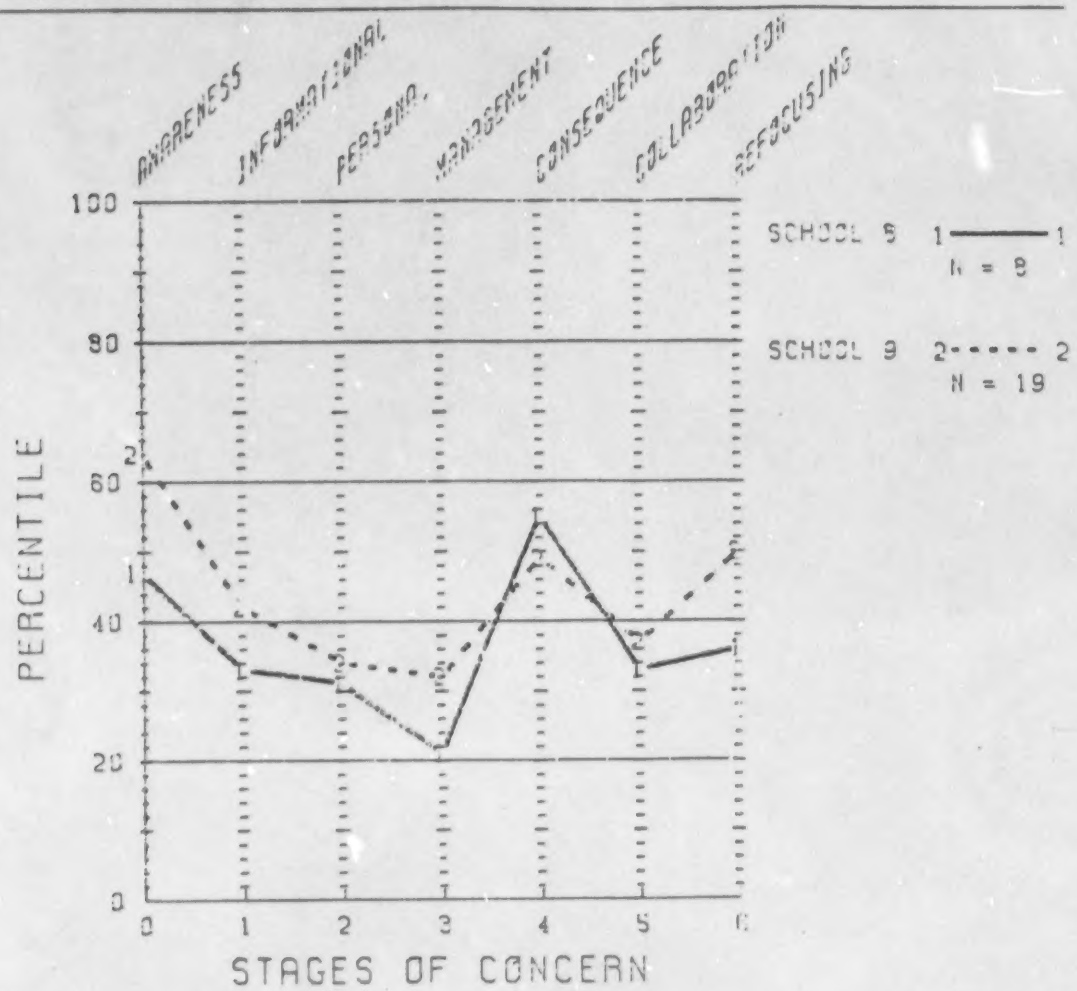
	0	I	II	III	IVA	IVB	V	VI	
SCHOOL 4	5	0	5	38	27	22	0	0	N = 18
SCHOOL 5	9	9	0	18	45	18	0	0	N = 11
SCHOOL 6	0	0	0	12	75	12	0	0	N = 8
SCHOOL 7	54	0	0	0	45	0	0	0	N = 11

PERCENT AT EACH LOU

IMPACT SCHOOLS

Figure 3

FINAL DATA COLLECTION



LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
SCHOOL 8	12	0	0	0	50	25	12	0	N = 8
SCHOOL 9	0	0	5	33	44	16	0	0	N = 19

PERCENT AT EACH LOU

groups. These commonalities and differences are described in the next sections of this paper. School and teacher variables are analyzed, the data available on principals are examined and hypotheses are proposed to explain what did and did not occur as the change process unfolded in each school.

Possible reasons for the clearly different concerns profiles for the schools in the different groups were many. The authors of the nine individual case studies developed interpretations and hypotheses to explain the SoC profiles and LoU distribution for each school. Interestingly, when the independently developed explanations for each school were compared for the schools within each grouping, many of the same conditions and factors were identified as probable causes.

Management Concerned Schools

These schools all have concerns profiles that are high on Stages 0, 3 and 6 (See Figure 1). The profiles are low on Stages 1, 2 and 5. Such profiles that are high on Stage 3 would indicate first of all high Management concerns. The high Stage 6 Refocusing scores indicate that the teachers have some strongly held ideas that the innovation should be used differently than it is, or perhaps not at all. The low Stage 1 Informational concerns suggest that these teachers are not interested in having more descriptive information about the innovation. The high Stage 0 score indicates that the innovation is not viewed as having a very large effect on them.

The Management Concerned Schools have large proportions of teachers at LoU III Mechanical use. Yet, two of the schools (Numbers 1 and 3) were in the first implementation phase, which means they had been using the innovation for a longer period of time. This suggests that time alone may not be sufficient for the resolution of Management concerns or movement out of Mechanical use.

A brief description of each school provides evidence of the factors influencing the implementation.

School 1: This Phase I school is in an older part of the district, students come from lower SES backgrounds, and the school buildings are older with self-contained classrooms and temporary buildings. At School 1 teachers do not team teach and do little cooperative planning. The school has a tradition of emphasis on the "basics" over science.

School 2: This Phase III school is in an older, settled area of the district. The students come from lower SES backgrounds, and declining enrollment indicates movement away from the community.

Though all the teachers have self-contained classrooms, there are several multi-grade classrooms in School 2. While there is no official "teaming," several teachers "departmentalize" and divide the instruction of subject matter. Classrooms are student-oriented, with an easy going, active cooperative atmosphere.

School 3: This Phase I school is located in a fast growing upper middle class neighborhood with many expensive new homes. The student population is growing at such a rate that it is threatening to overcrowd the building. The building, relatively new and modern, has open space classrooms where team teaching in many forms is the norm.

Science is taught in rotation with social studies and the teachers are on multi-grade level teams. This means that for at least two years (for a two-grade level team) the teachers could be teaching new units. Management of materials for science was an ever present problem within the school. Management techniques were suggested at the science inservices and the science consultants offered management assistance d ring school visits. The teachers at School 3 found the inservice sessions helpful, but some did not appreciate school visits, perhaps seeing these as part of a "checking up" process.

Tentative hypotheses that can be generated about Management Concerned Schools include:

a. Resolution of Management concerns does not simply occur with extended experience with the innovation.

b. Management concerned teachers see workshops that focus on management techniques as useful.

c. Teachers with high Management concerns combined with high Personal concerns may not be open to visits by innovation consultants, even though the intention is to provide "how-to-do-it" (Management) assistance.

d. Resolution of Management concerns may be hindered by Stage 6 Refocusing concerns, which indicate opinions about approaches different from the innovation.

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e. Age and style of the building and the SES of the students are not related to resolution of Management concerns.

f. Whether teachers are self-contained or in teams does not appear to be related to maintenance or resolution of high Management concerns.

Mixed Concerned Schools

The Mixed Concerned Schools are represented by relatively flat SoC profiles (See Figure 2). There are no extreme peaks or valleys across the stages although there are consistently high Stage 0 Awareness scores. Management (Stage 3) concerns are evident in most of these schools. Unlike the Management schools, the Mixed schools also show some indications of Stage 4 (Consequence) concerns. In general, the users tend to be at LoU IVA Routine with very few individuals at higher LoU's. There are some across-school differences to note, but in general these schools represent sites where the innovation has been implemented with a minimum of fuss. At some of these sites innovation configurations data indicate that the teachers are using minimal forms of the innovation; thus implementation would be relatively simple with little reason to have sustained high Personal or Management concerns.

School 4: This Phase I school is relatively new and modern. It is located in a rapidly developing upper middle class community. The "basics" are emphasized and team teaching and individualized instruction are used throughout the school.

Because of teaming and varying vacation schedules, teachers were confronted constantly with new teaching schedules, new groups of students and new teaming arrangements. For the first year of implementation, a science specialist in the school taught many of the science classes and served as a resource to other science teachers. During the second year the science specialist was phased out and all teachers taught science. Many of the teachers had experience teaching the previous science curriculum, and although they relied on the specialist when he was available, they were able to manage without him. Teachers did not seem to feel frustrated or even particularly concerned about these changes.

Teachers at School 4 responded positively to the inservice sessions and to assistance from the innovation consultants. Most teachers made an effort to follow the innovation users' guide closely. This led to fairly consistent use, but at the same time resulted in teachers feeling that they were not being creative.

School 5: This Phase III school, located in a middle class suburb, has a fairly stable enrollment. The building has both self-contained classrooms and open classrooms.

The teachers at School 5 were willing to adopt the new program, and some were even eager to cooperate. This school had a science curriculum incorporated into an established program. Many teachers were, therefore, "old pros" at teaching science. The new curriculum was viewed as beneficial, with minimal changes from the program they were accustomed to. Teachers at School 5 had a great deal of freedom and influence in decision-making within their own domains. It was assumed they would carry out district mandates but were free to do so in their own fashion.

School 6: This Phase I school is relatively modern, with a modified open concept floor plan. It is located in a middle income suburban neighborhood. The school staff are organized around grade level teams. It appears that on a weekly or perhaps monthly basis teachers pick and choose what they will do in relation to science as well as other areas. There is clear movement from non-use to use in the SoC and LoU data of School 6; however the high Stage 6 scores indicate teachers who may be dissatisifed with the innovation. This profile does not change over time and there is little indication of any interventions to address these concerns. It was also observed by the case study author that the LoU of teachers varied according to how familiar they were with different units.

School 7: School 7, a Phase III school, is in a middle-class suburban neighborhood. Its architecture is modern with open areas. The majority of teachers have at least eight years teaching experience and many have experience teaching science. Teachers often team teach, plan units together, and exchange students for science and social studies.

School 7 employs a full time science specialist teacher who teaches several science classes and assists other teachers in science-related activities. This is the likely reason for the continuing number of nonusers and for the "mixed" concerns of the teachers.

The school-based science specialist probably addressed any early Management concerns from the teachers. However, Impact concerns were not intense at the final data collection period. The SoC profile shows Informational concerns dominant, with Management and Impact concerns relatively equal and not particularly intense.

The science specialist also served as a science inservice leader. The principal of School 7 was a member of the Science Department's Principals Advisory Committee.

Tentative hypotheses about the Mixed Concern Schools include the following:

g. Movement to higher LoU's does not automatically follow the establishment of LoU IVA Routine use.

h. Past experience with practices similar to those required by the innovation results in lower Personal concerns and quicker resolution of Management concerns.

i. The resolution of Management concerns does not automatically bring arousal of Impact concerns.

j. An innovation specialist as a teacher and teacher resource within a building can anticipate and moderate Management concerns.

k. When one teacher is the major user of the innovation other teachers remain at nonuse and are likely to have less intense concerns about the innovation.

Impact Concerned Schools

Two schools in the study moved from nonuse to use with resolution of Management concerns and arousal of some Impact concerns. In both schools there was a steady increase over time in the number of teachers to LoU IVA and higher and a decrease in the number of persons at LoU III. The concerns profiles for the two Impact concerned schools (see Figure 3) peak on Stage 4 Consequence concerns. These teachers are indicating primary concerns about how the innovation and their individual use is impacting students. Teachers in School 9 have some ideas (high Stage 6) about alternative uses as well. The Stage 0 score suggests that neither faculty is overly consumed in their use of the Revised Science Curriculum in comparison to other aspects of their work.

One school was in Phase II and the other in Phase III. This suggests that the amount of time since initial implementation is not the major factor in

attaining Impact concerns. None of the schools in the earliest adoption phase had teachers with Impact concerns at the final data collection period.

School 8: In Phase III, School 8 is in an older part of the district and the students come from lower SES backgrounds. The building is older with self-contained classrooms. The majority of teachers had at least eight years of teaching experience. Teachers often taught in teams, planned together and exchanged students. School 8 had had a science program in the past and most of the teachers were accustomed to teaching science. The school had a teacher who participated in writing science units and was an inservice leader for the innovation. The principal served on the Science Department's Advisory Council. Also in School 8, seven of the eight grade 3-6 teachers were responsible for teaching science, so the burden of implementation was spread among the staff.

School 9: This Phase II school is located in a newly developed outlying, middle class suburb. The architectural design of satellite areas provides a quasi open-structured facility. The pupils have higher SES parents who represent professional and business backgrounds. Two-thirds of the students attend school at any given point in time, as this is a year-round school, with all constituents divided into thirds for attendance.

Teachers are described as "old pros" in science and other instructional areas, with no particular problems. These teachers, already experienced in teaching science and in teaming for science, were looking forward positively to learning about and using the new science program. The faculty has been described as friendly, and also as strong, with "opinionated" teachers. Active and available to the faculty early in the implementation was an inservice leader. Two years later an additional science inservice leader was transferred to this school. The principal served on the Science Department's Principals Advisory Committee.

Additional hypotheses about implementation are proposed from the study of Schools 8 and 9 (Several of these have also been suggested as influencing Management and Mixed Concerns Schools.):

m. Movement to institutionalization, Refinement LoU's and Impact concerns is not simply related to extended experience with the innovation.

n. If past practice closely approximates the innovation then individuals in the change process can move more quickly to Impact concerns.

o. An in-the-building innovation specialist, such as an inservice leader for the innovation, can help resolve Management concerns.

p. A teacher in the building who helped develop the innovation can facilitate implementation at the building level.

q. Instructional and administrative staff who have outside the building involvement in innovation related activities can facilitate building use.

r. Teaming can help facilitate implementation by providing mechanisms for coordination, communication and the exchange of information.

s. The SES of the students is unrelated to the rate of change.

t. The architectural characteristics of the building are unrelated to the rate of change.

THE PRINCIPAL AS KEYSTONE

In reporting the preceding descriptions and hypotheses, references to the principal were deliberately kept to a minimum. This was done in order to explore other variables that affect change or non-change of teachers and also to provide background to the emerging hypotheses about the effects of the building administrator.

In the case studies there are references to behaviors of and interventions by the principals. The amount of information available for each principal varied considerably depending on where the ethnographer, district staff and research staff happened to spend their time. However, general impressions can be developed in all cases. Brief summaries of the descriptions of each principal are presented in Table 2. These descriptions are not always complete, but provide some flavor of the persons and what they do. Note that the principals are grouped in the same way as the schools.

Based on our field work and the analyses of the data in the case studies it appears that the principals functioned differently in the different kinds of schools. Principals in the Management Concerned Schools did not get personally

Table 2

Excerpts of Principal Descriptions from the
Mini-Case Studies of Nine Schools

Management Concerned Schools

School 1	Concerned with maintaining status quo. Did not communicate with teachers regarding the innovation. The administrative assistant was new to the school and received no information from the principal about implementation requirements. The administrative assistant handled everything related to science.
School 2	Not often around when interviewers came but was always friendly when they met. More than once reported being with a child. Jotted down notes about suggestions from science consultants. Permitted teachers to make their own decisions about whether to teach science or not. Says "the students come first." Concerned with instruction in general, not with any particular subject area.
School 3	Shares thoughts, opinions and philosophy openly with teachers. Differentiates teachers based on their philosophies and reactions to the innovation. Talks to research staff about where teachers are in relation to the innovation and mentions no plans to intervene. Does not monitor time allotment for science. Assigned teacher to handle school science materials but did not monitor. Was in favor of teaming but did not work to link teachers since each teacher was perceived as being a leader. Views faculty as playing a crucial role in implementation. Is aware of the feelings and opinions of the teachers and to a degree knowledgeable about what is going on in classrooms. Questions the district's time allotment for science when talking to teachers and district administrators. Views teachers as dedicated leaders, effective communicators with parents and student-oriented. Sees teachers as sharing openly with the principal. Sees principal and teachers as responding to parents.

Mixed Concerned Schools

School 4	Has a wide program focus and is not overly committed to one particular subject area. Maintains various kinds of innovation thrusts. Reads much of the professional literature. Feels almost powerless against pressure from central administration. Also feels a lot of community pressure.
School 5	Appears comfortable with the principal's role. Teachers were always informed and scheduled for data collection. Style of interaction is "peer to peer." Does his job competently and carries out the mandated missions of the central office. The principal "tossed off" science consultant's suggestions for interventions that would have required direct authoritative supervision. Attitude toward the innovation was one of acceptance, not enthusiasm nor resistance.
School 6	Not readily accessible to outsiders. The principal frequently asked if the study was over, but continued to keep the school in it although the teachers were not enthused. P'ayed a minimum role of involvement in the implementation. Did not require teachers to attend all of the inservice sessions. Was not consistent in support of the innovation. Seems to have mixed feelings about the innovation and its implementation.
School 7	Communicated to teachers the expectations that science be taught. Served on the science department's Principal Advisory Committee. More administrative than instructional in approach to teachers. Communicated expectations and consulted with teachers when problems arose. Treated the innovation as one of many curriculum areas and not a major emphasis.

Impact Concerned Schools

School 8	Communicated to the teachers the expectation that science be taught. Required district curricula and time allotments be adhered to. Gave special attention to science in first year of implementation. Personally attended to the management of equipment and materials. Served on Principal Advisory Committee. Consciously intervened in many ways to ensure acceptance and use of the innovation. Once a week ate lunch with a small group of children. Has and can describe long-term goals for the school. Wants teachers to communicate with one another and work together. Wants kids to be comfortable in and feel good about school.
School 9	Said "I put their (the staff's) feet to the fire." Insisted that teachers would teach the new science. Said, "We are going to implement it." Solicited teachers problems and used a problem-solving approach relative to science. Insists that the buck still stops with the principal who does not abdicate authority. Can describe actions taken with each teacher and how it fits into a larger game plan. Can articulate assumptions underlying the interventions made. Found needed materials for teachers. Served on Principals Advisory Committee. Believes the principal should back staff with support and abundant equipment. Thinks far ahead and is planning to make changes.

involved with teachers and their use of the science innovation. Rather, these principals delegated responsibility or made overall decisions with little follow-up on the results. For example, in School 1, the principal assigned the administrative assistant to handle anything related to science, and in School 3, the principal assigned a teacher to handle science materials but did not periodically check to see what was happening. The principals in these schools seemed to be more concerned with general issues rather than specifics and left teachers on their own to determine how to implement the innovation.

The principals in the two Impact Concerned Schools, 8 and 9, were by comparison "science activists." They were concerned about supporting and helping teachers in their use of the innovation. On a weekly and daily basis they were monitoring what teachers were doing with science. They set policy within the school that clearly indicated that science would be taught. They worked on teacher-specific implementation problems. They also served on the district-wide principals committee for science. In addition, these principals were described as having long-term goals and visions for their schools and teachers. There is a dynamic energy about them, a sense of commitment and direction for attaining their goals.

The principals in the Mixed Concerned Schools have some attributes of both Management and Impact Concerned School principals. The principal in school 7, for example, also served on the district principals committee for science and communicated to teachers expectations about the teaching of science, suggesting Impact concerns. Yet, the energy is not there; the principal is described as "comfortable and interested" and "more administrative than instructional" in approach.

Principals in schools 4 and 6 did not seem to be concerned about science as a special priority. Other activities that seemed to compete with science were

encouraged (e.g., maintaining different innovation thrusts in school 4 and not requiring attendance at science inservice in school 6). In total, the principals in the Mixed Concerned Schools seemed to have sent mixed messages to their teachers. In several cases these principals appear to be less clear about long-term goals for their schools.

Based on these data and analyses, a set of hypotheses are proposed about principals and their effects on school change efforts. It appears that the concerns model can be applied to principals in their facilitation of an innovation as it has been applied to teachers in their use of an innovation. The first two hypotheses focus on principals' concerns in relation to their change facilitating role during the implementation of the innovation. The third hypothesis focuses on the interactions between the concerns of principals and their effects on teachers.

The hypotheses are:

1. Principals have Stages of Concern about their roles as change facilitators that can be described in the same way as the Stages of Concern that teachers have about innovations.

2. The interventions that principals use (i.e., their change facilitating style) will vary with their own Stages of Concern.

3. The arousal and resolution of teachers' concerns is related to the Stages of Concern and change facilitating behaviors of their principal.

    a. Teachers of principals who are not as concerned about impact and do not take active facilitating and managing roles relative to an innovation will have more intense Stage 3 Management concerns and they will last longer.

    b. Teachers of less involved or more inconsistent principals are apt to have high Stage 3 Management concerns coupled with high Stage 6 Refocusing concerns, indicating ongoing dissatisfaction with innovation related logistical issues.

    c. Teachers of Impact concerned principals who set directions, clarify school curriculum goals, and become actively involved with implementation will have lower and shorter Management concerns and will move to arousal of some Impact (Stages 4, 5, 6) concerns.

These hypotheses result from the case studies and from our clinical impressions. At this time it appears that a most important factor to explain the quality and quantity of change in these schools is the concerns of the principals and what the principals did and did not do.

Epilogue

In this paper nine schools were placed into one of three groups based on change criteria that used the teachers and the innovation as the frame of reference. For us, the most important nypothesis emanating from these data is that the implementation of the innovation is different in different schools primarily because of the actions and concerns of the principal. In hindsight we suspected that we could have sorted these schools, based on analysis of the principals' concerns and change facilitating behaviors, into the same three groups that we obtained by using the SoC and LoU data of the teachers.

As an after-the-fact test of this hypothesis we wrote the name of each school on a card. We then asked two of our colleagues who know these schools and their principals to make three groups out of the nine cards, based on the "change facilitating style of the principal." They were then asked to describe the reasons for their groupings. The first staff member grouped the schools the same as the SoC groupings except put School 6 with what is labeled the Management Concerns Group and having School 2 with the Mixed Concerns Group. She did not know the principal of School 5 well enough to classify.

The second staff member also formed the same basic groups. She placed School 7 with the Impact Concerns Group, which we had also done at one point, and she identified as uncertain Schools 2 and 6 but felt that each belonged either in the Mixed Group or the Management Group.

The "quick and dirty" expert judge rating and sorting of principal change facilitating style resulted in almost identical groupings of the schools that had been obtained earlier using the quantitative SoC and LoU data of the teachers. These analyses point toward the dynamic interdependence between teachers as front line users of educational innovations and the building administrator as policy and norm-setter, resource and reward allocator. The building administrator's concerns appear to set thresholds or facilitate movement of their staff as they experience the change process.

SUMMARY

In this paper we have described our analyses of qualitative and quantitative data collected in nine elementary schools as part of a longitudinal study of implementation in one large suburban school district. These data were combined into a set of nine "mini-case studies." Out of these analyses, we have developed a set of hypotheses about factors that affect change at the school building level. The district context was controlled by district-wide curriculum and use of the same implementation game plan for all schools.

Our analyses lead us to the conclusion that the schools could be sorted into three groups based on the Stages of Concern and Levels of Use data of the teachers. Hypotheses were proposed about factors that affected the arousal and resolution of teacher concerns. Characteristics of the building principals were examined and the proposal was made that principals experience Stages of Concern and that the change facilitating role that a principal takes is related to their concerns. We hypothesized that the schools could be grouped in the same clusters if the principals' concerns and change facilitating role were used as the basis for sorting. Finally, we hypothesized that there is a relationship between the principals' concerns and their change facilitating behaviors and the

arousal and resolution of teachers' concerns and movement or non-movement of teachers' Levels of Use.

We in the CBAM project, our field site colleagues and our NIE colleagues are intently interested in further developing and testing these hypotheses. As one next step, a two-year study of principals with different concerns is now being launched. Development of a measure for assessing change facilitator concerns is near completion and procedures for documenting principal interventions has been pilot tested.

Over the next several years we hope to contribute new insights to the research, practice and policy communities about the relationships between change in the classroom and what the building administrator does and doesn't do. Contrary to much that has been written, it does not appear that teachers involved in change are isolated from the effects of building level interventions by simply closing their classroom door. Further, it appears that no matter what the principal's change facilitating orientation, there are direct but differential effects on teacher's concerns and classroom practice.

If research affirms these hypotheses, then those involved in the selection and training of administrative personnel, and management and evaluation of the change process will have to take into account a new set of variables not presently being considered. To policy level variables, district-wide variables and classroom level variables there will need to be added clearer descriptions of the building level influences on implementation, specifically the concerns and change facilitating behaviors of the principal.

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Appendix A -- Stages of Concern Definitions

Appendix B -- Levels of Use Definitions

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Appendix A

Definitions:

STAGES OF CONCERN ABOUT THE INNOVATION*

6 REFOCUSING: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.

5 COLLABORATION: The focus is on coordination and cooperation with others regarding use of the innovation.

4 CONSEQUENCE: Attention focuses on impact of the innovation on students in his/her immediate sphere of influence. The focus is on relevance of the innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.

3 MANAGEMENT: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.

2 PERSONAL: Individual is uncertain about the demands of the innovation, his/her inadequacy to meet those demands, and his/her role with the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision-making and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.

1 INFORMATIONAL: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.

0 AWARENESS: Little concern about or involvement with the innovation is indicated.

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*Original concept from Hall, G. E., Wallace, R. C., Jr., & Dossett, W. A. A developmental conceptualization of the adoption process within educational institutions. Austin: Research & Development Center for Teacher Education, The University of Texas, 1973.

Measurement described in Hall, G. E., George, A. A., & Rutherford, W. L. Measuring stages of concern about the innovation: A manual for use of the SoC Questionnaire. Austin: Research & Development Center for Teacher Education, The University of Texas, 1977.

Appendix B

LEVELS OF USE OF THE INNOVATION

LEVELS OF USE	DEFINITION OF USE
0 NONUSE	STATE IN WHICH THE USER HAS LITTLE OR NO KNOWLEDGE OF THE INNOVATION, NO INVOLVEMENT WITH THE INNOVATION, AND IS DOING NOTHING TOWARD BECOMING INVOLVED.
Decision Point A	Takes action to learn more detailed information about the innovation.
I ORIENTATION	STATE IN WHICH THE USER HAS RECENTLY ACQUIRED OR IS ACQUIRING INFORMATION ABOUT THE INNOVATION AND/OR HAS RECENTLY EXPLORED OR IS EXPLORING ITS VALUE ORIENTATION AND ITS DEMANDS UPON USER AND USER SYSTEM.
Decision Point B	Makes a decision to use the innovation by establishing a time to begin.
II PREPARATION	STATE IN WHICH THE USER IS PREPARING FOR FIRST USE OF THE INNOVATION.
Decision Point C	Changes, if any, and use are dominated by user needs.
III MECHANICAL USE	STATE IN WHICH THE USER FOCUSES MOST EFFORT ON THE SHORT-TERM, DAY-TO-DAY USE OF THE INNOVATION WITH LITTLE TIME FOR REFLECTION. CHANGES IN USE ARE MADE MORE TO MEET USER NEEDS THAN CLIENT NEEDS. THE USER IS PRIMARILY ENGAGED IN A STEPWISE ATTEMPT TO MASTER THE TASKS REQUIRED TO USE THE INNOVATION, OFTEN RESULTING IN DISJOINTED AND SUPERFICIAL USE.
Decision Point D-1	A rountine pattern of use is established.
IVA ROUTINE	USE OF THE INNOVATION IS STABILIZED. FEW, IF ANY, CHANGES ARE BEING MADE IN ONGOING USE. LITTLE PREPARATION OR THOUGHT IS BEING GIVEN TO IMPROVING INNOVATION USE OR ITS CONSEQUENCES.
Decision Point D-2	Changes use of the innovation based on formal or informal evaluation in order to increase client outcomes.
IVB REFINEMENT	STATE IN WHICH THE USER VARIES THE USE OF THE INNOVATION TO INCREASE THE IMPACT ON CLIENTS WITHIN THE IMMEDIATE SPHERE OF INFLUENCE. VARIATIONS ARE BASED ON KNOWLEDGE OF BOTH SHORT- AND LONG-TERM CONSEQUENCES FOR CLIENTS.
Decision Point E	Initiates changes in use of innovation based on input of and in coordination with what colleagues are doing.
V INTEGRATION	STATE IN WHICH THE USER IS COMBINING OWN EFFORTS TO USE THE INNOVATION WITH RELATED ACTIVITIES OF COLLEAGUES TO ACHIEVE A COLLECTIVE IMPACT ON CLIENTS WITHIN THEIR COMMON SPHERE OF INFLUENCE.
Decision Point F	Begins exploring alternatives to or major modifications of the innovation presently in use.
VI RENEWAL	STATE IN WHICH THE USER REEVALUATES THE QUALITY OF USE OF THE INNOVATION, SEEKS MAJOR MODIFICATIONS OF OR ALTERNATIVES TO PRESENT INNOVATION TO ACHIEVE INCREASED IMPACT ON CLIENTS, EXAMINES NEW DEVELOPMENTS IN THE FIELD, AND EXPLORES NEW GOALS FOR SELF AND THE SYSTEM.

From: The LoU Chart. Austin: Research and Development Center for Teacher Education, The University of Texas, 1975.

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THE EFFECTS OF A CONCERNS-BASED IMPLEMENTATION PLAN ON THE ACHIEVEMENT OF ELEMENTARY SCIENCE STUDENTS

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Paper presented at the annual meeting of the
American Educational Research Association,
Boston, April, 1980

THE EFFECTS OF A CONCERNS-BASED IMPLEMENTATION PLAN ON THE ACHIEVEMENT OF ELEMENTARY SCIENCE STUDENTS[1]

Harold Pratt

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Introduction

The ultimate purpose for the implementation of a new curriculum is the improvement of the educational opportunity of the students involved. This usually means changing a program presented to students or improving student achievement in a given content or subject area. Recently the framework of the Concerns-Based Adoption Model (Pratt, Melle, Metzdorf & Loucks, 1980) was used to guide the implementation of a revised elementary science program in grades 3-6 in the Jefferson County, Colorado Public Schools. One of the previous findings of research related to the model is that the level at which an innovation is used improves or increases over time measured in terms of years (Hall & Rutherford, 1976). Since one of the major assumptions of CBAM is that the implementation of an innovation should be considered a process, not an event, the Level of Use (LoU) of the revised elementary science program was

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[1]The research described herein was conducted under contract with the National Institute of Education. The opinions expressed are those of the authors and do not necessarily reflect the position or policy of the National Institute of Education, and no endorsement by the National Institute of Education should be inferred.

monitored for more than two years before, during and after the year-long in-service plan. The results of this study (Loucks & Melle, 1980) show that the Level of Use of the revised program did increase over the period of time of the study. This paper explores how student achievement on a locally developed, criterion-referenced test is related to the length of time the revised science program has been in use.

As previously stated, CBAM assumes change to be a process. In order to provide more time for the process to occur, three one-day sessions of inservice were scheduled approximately three months apart, allowing teachers an opportunity to use the new program between sessions. (See Pratt, Melle, Metzdorf & Loucks, 1980, for more details of the inservice plan.) Because of the large number (approximately 700) of elementary teachers involved, the district was divided into three equal groups of schools, or phases. Phase II and Phase III began their inservice programs about four months and twelve months, respectively, after Phase I. This "phasing in" over time of the revised program provided an opportunity to measure the difference between student achievements in classrooms whose teachers had implemented the new program the earliest, and classrooms whose teachers started using the program at a later time. The time difference in implementation was as long as one year. This allowed direct measurement of the relationship between student achievement and length of time that a teacher had been using the new material.

Test Development Procedures

The Jefferson County elementary science program consists almost entirely of "hands-on" type units from either Elementary Science Study (ESS) or Science Curriculum Improvement Studies (SCIS). Because of its nature, the program

developers considered it inappropriate to measure student achievement within such a curriculum by a multiple choice test. It was thought perhaps a commercially available standardized test had been developed which correlated inquiry skills or processes that could be directly observed during a "hands-on" lesson. A search of the literature in 1974 by the Bureau of Educational Field Services at the University of Colorado failed to produce such a test (Riley, 1975).

The science department therefore tackled the task of creating a sixth grade test that would be an adequate measure of student achievement in a very active, "hands-on" inquiry curriculum. To do so, two essentially parallel versions of the same test were created. The first was a "hands-on," one-to-one test in which the student manipulated materials and equipment to display a mastery of specific science concepts or understandings. Such a test would be highly unfeasible to administer in a large school district because of cost involved. Therefore, a second version of the test was created in a multiple-choice format. If a strong correlation could be found between these two tests then it could be assumed that both tests were measuring the same construct, and the easier to administer multiple choice test could be used. If the correlation did not exist, then a small random sample of students could be administered this one-to-one test, and district results extrapolated from their results.

The first step in the test development was to identify those concepts representative of the elementary program in grades 3-6. Science inservice leaders (classroom teachers who had been trained in conducting science inservice classes) and those who had helped write and pilot-test the new curriculum were asked to identify specific concepts from each unit they thought were important for students to know. Once this list of "objectives" was completed, this same group

of people wrote "hands-on," one-to-one items for each of the specific concepts. At the same time they wrote corresponding multiple choice items matching the "hands-on" items. After the items were reviewed a number of times the two versions of the test were prepared for pilot-testing.

Pilot Test Procedures and Results

Three pilot-test schools were chosen so as to provide students with a wide range of ability, socio-economic population and previous experience with the science program. Fifty-nine students were randomly selected from nine sixth grade classrooms. Three testers were trained to administer the "hands-on" test and their reliability informally established. Due to the length of the "hands-on" test each student received three-fourths of the "hands-on" items. The multiple choice was administered by one of the testers by being read aloud during a 75 minute testing session. Half of the sample received the multiple choice before the "hands-on" test and the other half after. Twenty-four items from the National Assessment of Educational Progress (NAEP) Science Tests for nine and thirteen year olds were embedded in the multiple choice test. These items were selected because they had been carefully screened and evaluated for use in the national instrument, and because their content coverage was very closely related to the district program. Ultimately, student scores on these items could be used for a limited comparison between local achievement results and those at the national level. In addition, CTBS reading comprehension scores were available on each student from tests that had been administered a few months earlier.

Norris Harms (1978) of the Bureau of Educational Field Services of the University of Colorado executed an extensive item and test analysis. Several scales were defined in the areas of physical science, environmental science, astronomy and earth science, and health science, as well as the NAEP multiple

choice items and the locally developed multiple choice items. Figure 1 shows the number of items on each scale, an estimate of each scale's reliability, mean and standard deviation and the number of students tested. Because each student in the sample responded to only approximately three-fourths of the one-to-one test items, the reliability of the entire one-to-one scale was estimated by using the Spearman-Brown formula. This calculation is displayed in Figure 2.

Figure 1

SCALE	NUMBER OF ITEMS	RELI-ABILITY	MEAN	STANDARD DEVIATION	NUMBER STUDENTS TESTED
Health 1-1	25	.72	13.9	3.72	40
Physical Science 1-1	16	.58	8.6	2.58	42
Environment 1-1	18	.52	9.7	2.64	42
Astronomy - Earth	14	.25	6.6	1.76	42
Total 1 1	73	.80*			
Jeffco Multiple Choice	71	.78	42.0	7.90	59
NAEP Multiple Choice	24	.80	16.3	4.37	59
All Multiple Choice	95	.86	58.4	11.32	59
CTBS			53.2	70.1	

*Estimated using the Spearman-Brown formula (See Figure 2).

Figure 2

RELIABILITY ESTIMATES - ONE-TO-ONE SCALE

GROUP I - (Health and Physical Science and the Environment) r_{tt}=.79

GROUP II - (Health and the Environment and Earth/Astronomy) r_{tt}=.75

GROUP III - (Physical Science and the Environment and Earth/Astronomy) r_{tt}=.63

GROUP IV - (Health and Physical Science and Earth/Astronomy) r_{tt}=.82

Mean r_{tt}=.75

Estimate of r_{tt} for whole test (r_{tt}=.75 adjusted for a length of 4/3 by Spearman Brown formula).

$$n = \frac{nr_{tt}}{1 + (n-1)r_{tt}} = \frac{4/3\ (.75)}{1 + (1/3)\ (.75)} = \frac{1}{1.25} = .80$$

Our best estimate of r_{tt} is .80. This estimate should be fairly accurate, with little error due to sampling.

A correlation matrix between the individual scales is provided in Figure 3. It should be noted that the multiple choice scores correlate somewhat higher with the CTBS reading scores than do the "hands-on," one-to-one scores. Thus it appears that performance on the one-to-one scale is somewhat less dependent on reading than are the paper and pencil multiple choice scores. It is notable that the district one-to-one test correlates higher with the district multiple choice items than with the NAEP multiple choice items. This indicates that the Jeffco multiple choice scale comes closer to measuring that domain identified by the one-to-one scale and, therefore, the district curriculum as presented to students, than does the NAEP scale.

The .66 correlation between the district multiple choice items and the district one-to-one items indicates an acceptable degree of agreement between the two scales. Thus, to the extent that the one-to-one test measures the district objectives in curriculum program, the district multiple choice test also measures these objectives. We therefore decided to measure student achievement using the multiple choice test, not the one-to-one test.

Figure 3

SELECTED CORRELATION MATRIX - COGNITIVE AND ONE-TO-ONE SCALES

	Jeffco 1-1 Average**	Jeffco M.C.	NAEP M.C.	All M.C.	CTBS Reading
Jeffco 1 to 1	1.0	.66	.48	.66*	.31
Jeffco M.C.	.66	1.0	.69	.96	.46
NAEP M.C.	.48	.69	1.0	.87*	.38
All M.C.	.66	.96*	.87*	1.0	--
CTBS Reading	.31	.46	.38	--	1.0

*Note that the "Jeffco Multiple Choice" and NAEP Multiple Choice scores are combined to produce the "all multiple choice" scores. The correlations of part to whole scores include some auto-correlation and are high.

**Average computed via Fisher Z.

Field Test

The development of the field test version of the multiple choice test during the second year (1978-79) concentrated on the reduction and refinement of the multiple choice items. The field test version could also be used to compare student achievement among the three phases of implementation. The three phases represent the schedule for which teachers attended the inservice

for, and subsequently began teaching, the revised elementary science program.

Phases	Dates of Inservice	Months of Experience with Revised Program at Time of Test Administration
I	Jan 1977-Sept 1977	29
II	Mar 1977-Sept 1977	25
III	Jan 1978-Sept 1978	17

The students from the phases were matched by selecting a sample from each one so that the distribution of CTBS reading comprehension scores was the same as the distribution of scores in the total district. Figure 4 displays the scores for CTBS reading comprehension of the sample populations. Each of the twelve schools administered their own test with students reading the items themselves with no time limit.

Figure 4

CTBS - 1978-79

Grade 6

Reading Comprehension (ESS)

Sample Population

	N	X	S.D.
TOTAL	174	558.1	80.3
Phase 1	59	558.9	78.3
Phase 2	61	556.6	80.8
Phase 3	54	559.0	81.9

Kuder-Richardson formula 20 estimates of internal consistency are shown in Figure 5.

Figure 5

Scale	Number of Items	Reliabilities
Health	30	.61
Physical	25	.60
Environmental	32	.76
Earth/Astronomy	13	.46
Total	100	.86

A step-down, linerar-models approach was used to analyze the data on all scales. The models used can be thought of as an expanded analysis of covariance, the expansion being tests of assumptions made in conventional analysis of covariance.

The first model used contains nine parameters. Essentially, data points from each phase were used to estimate three parameters independently. Within each phase, the model had the form:

$$Y = a_0U + a_1X + a_2X^2 + E,$$

where U is the unit vector,

X contains the CTBS reading score,

X^2 contains CTBS reading score squared,

and Y contains the dependent variable.

This model is familiar to many readers as it is used frequently to fit data with a curved line.

The first "restriction" or step-down placed on the model was to require that the estimate of the parameter on the squared CTBS score, a_2, be the same for all three groups. This resulted in a model with seven parameters, a separate a_0 and a_1 for each group and a common a_2.

The second restriction tested the hypothesis that this common parameter,

estimated using data from all three groups, was actually zero. That is, is it necessary to use curved lines, or do three straight lines fit the data as well? This restriction resulted in a model with six parameters, an independent slope, a_1, and intercept, a_0, for each group.

The third restriction tested the hypothesis that the slope of the line, estimated by a_1, was the same in all three groups. That is, is it reasonable to assume that the three lines are parallel? This restriction resulted in a model with four parameters, three separate intercepts, one for each group, and a common slope.

The fourth, and final, restriction tested the hypothesis that the intercepts were the same. That is, whether it was reasonable to assume that there was no difference between the groups. This resulted in a two parameter model, simply a slope and intercept for the entire sample.

When each restriction was imposed, an F-test was used to evaluate the increase in error when the simpler model was used to fit the data. The step-down process was not followed beyond the point the first significant ($p<.05$) F-ratio was found (Ward & Jennings, 1973). In three of the five cases (Total Score, Physical and Earth/Astronomy), the seven parameter model was significantly "better than" the six parameter model. In the other two cases (Health and Environmental), the six parameter model was determined to be superior to the four parameter model. Thus, significant differences between the groups were found in all five analyses.

Each of the analyses was replicated using the CTBS Math score as the covariate, with nearly identical results. Even though there were some differences in the value of the tests at each step, the implications of the analyses were the same, so only the analyses using the reading scores are detailed here. (See Figures 11 and 12 to compare Reading and Math as covariates.)

The analyses indicate that more experience with the science program led to increased achievement for high ability students. High ability students in Phase I schools did better than high ability students in Phase II schools, who in turn out performed high ability students in Phase III schools. For medium and low ability students, the achievement scores were essentially the same across the three phases. This interaction between ability and performance is apparent in the analysis of the Total Score (Figure 6), the Physical Strand (Figure 7) and Health Strand (Figure 8).

Figure 6

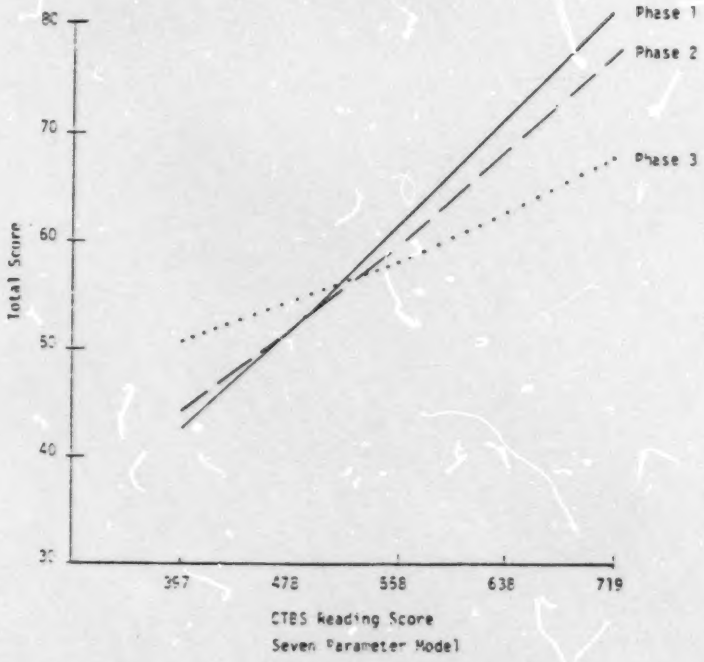

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Figure 7

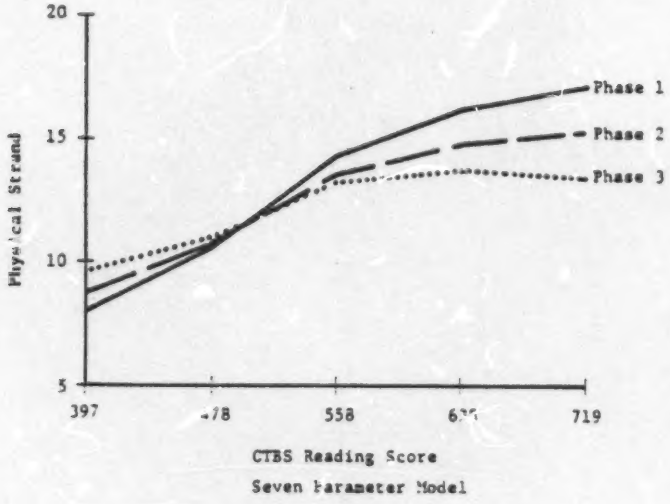
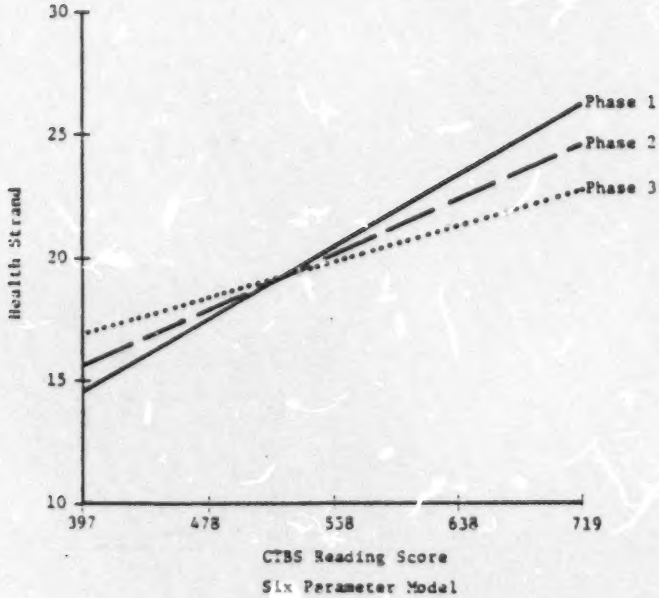


Figure 8



Somewhat different results were obtained on the other two scales. On the Environmental Strand (Figure 9), Phases I and II were essentially identical. These two groups were very similar on the Earth/Astronomy Strand (Figure 10) items also, even though Phase I students very slightly out scored Phase II at all levels of ability. In each of these subtests, a strong interaction between reading ability, performance on the science achievement test, and the phase of science implementation is apparent. In every case, Phase I and III maintain the same relationship, high ability students in Phase I do better than high ability students in Phase III. But low ability Phase III students do as well as or better than low ability Phase I students.

Figure 9

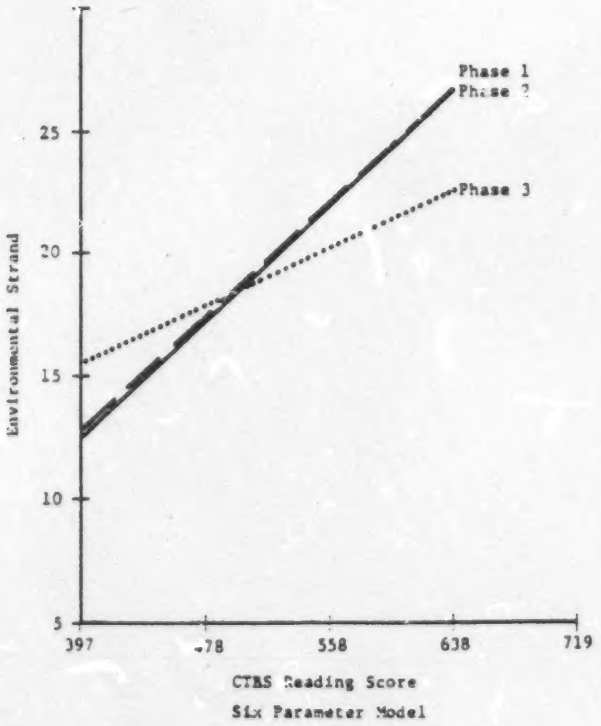
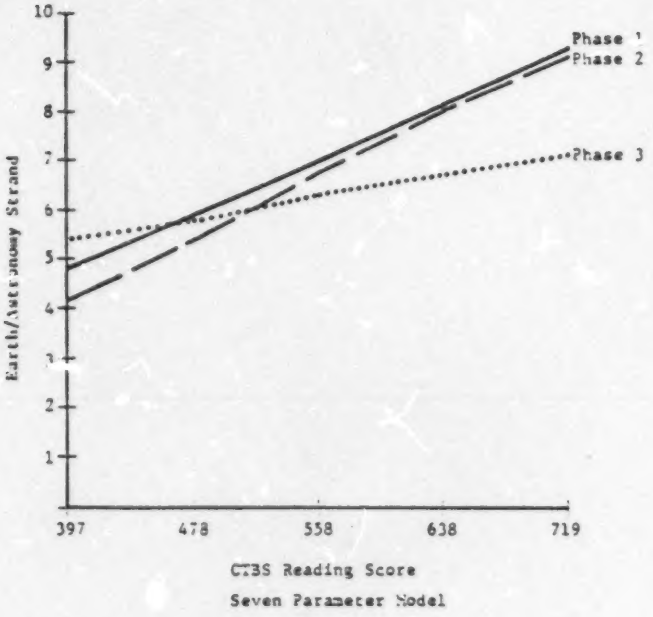


Figure 10



A procedure developed by Johnson and Neyman (1936) and programmed by Borich (1971) was used to test for "regions of significance" in the analyses of the science achievement data. The CTBS reading and math scores were used in separate analyses, and phases were compared on a pair-wise basis -- 1 and 2, 2 and 3, and 1 and 3. The Johnson-Neyman test provides cut-off scores above and below which the groups have different expected values, if the regression lines cross. Figures 11 and 12 show the results of the tests for both reading and math scores, and for each of the content areas in the science curriculum. Figures 13 and 14 show the graphical representation of the results of the test.

Comparisons of Phases II and III revealed several significant differences, especially using reading as the covariate. Phase II students of moderate to high ability did better on the Environment, Earth/Astronomy, and Total Scores than students in Phase III of equal ability. On several scales, it appears

Figure 11

	1 vs 2	2 vs 3	1 vs 3
Health:	ns	ns	3>1, R 442 1>3, R 620
Physical:	ns	ns	1>3, all R
Environmental:	ns	3>2, R<358 2>3, R>596	3>1, R<390 1>3, R>609
Earth/Astronomy:	ns	2>3, R>619	1>3, all R
Total:	ns	2>3, R>589	3>1, R<435 1>3, R>573

Results of Johnson-Neyman Test for Differences in Expected Values on Each of the Cognitive Scales Using CTBS Reading Score as the Predictor

Figure 12

	1 vs 2	2 vs 3	1 vs 3
Health:	ns	ns	ns
Physical:	ns	ns	1>3, all M
Environmental:	ns	2>3, M>559	3>1, M<406 1>3, M>544
Earth/Astronomy:	ns	ns	1>3, all M
Total:	ns	ns	1>3, M>528

Results of Johnson-Neyman Test for Differences in Expected Values on Each of the Cognitive Scales Using CTBS Math Score as the Predictor

Figure 13

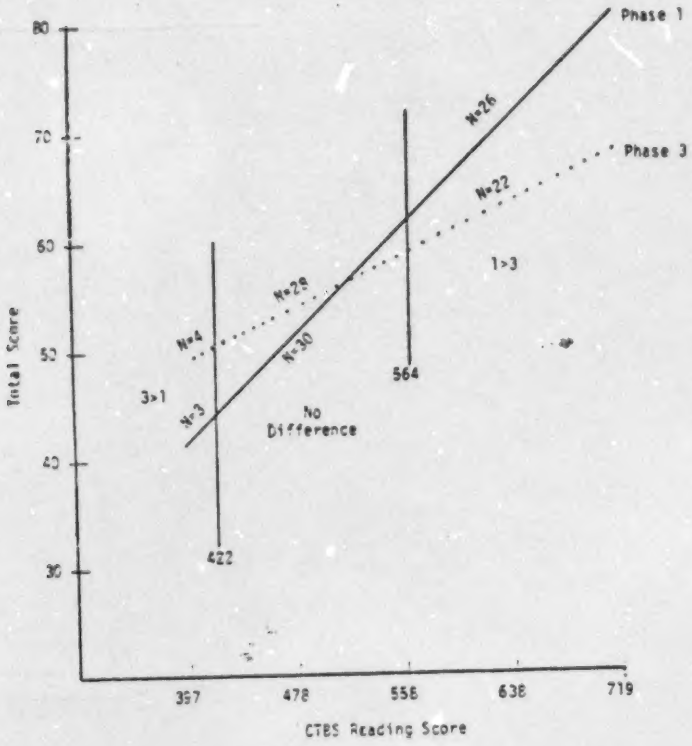
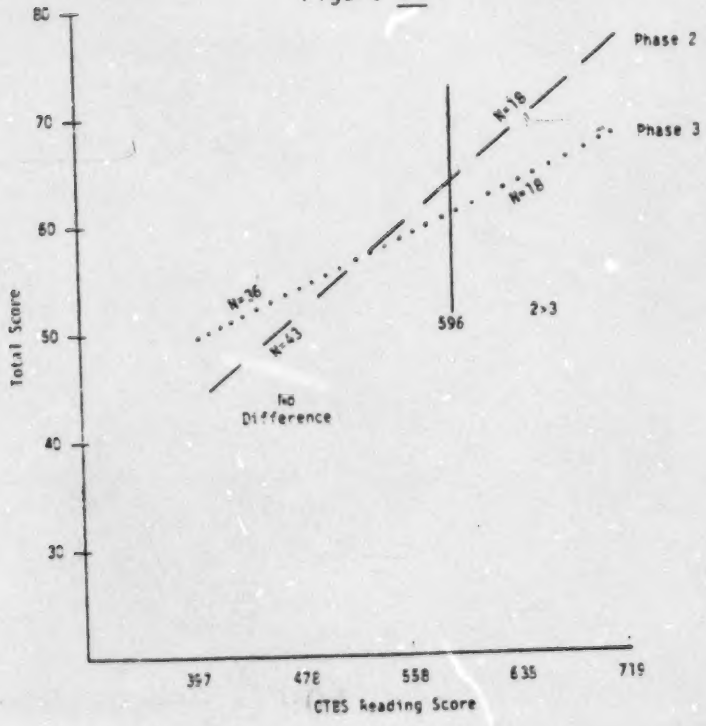


Figure 14



that students of lower ability in reading did better in Phase III than Phase II. However, this is largely illusionary -- less than 3% of the students in the sample had scores lower than 400 on the reading test. Thus, the apparent differences are based on projections of the slope of the line into this region of little data. Apparently, because the high ability students in Phase II dramatically out performed the high ability students in Phase III, and there was no difference in performance between the phases for students in the middle range, the regression lines cross. The interaction is not due to an inversion of the performance among lower ability students. The regression lines cross because of very great differences in achievement among the high ability students and the essentially equal performance of students in the low to moderate range of ability.

Very few students had CTBS scores which would be considered low in any other context. A score of 400 on the reading scale is only one standard deviation below the national average. Approximately 16% of scores are expected below this point, but only 3% are observed there. Thus, it is really not possible to say how students of low ability would perform on these tests, nor whether there would be differences between the phases in that range of ability.

Comparison of Phase I and III reveals many more differences than either of the two previous comparisons. When reading scores were used as the covariate, students of moderate to high ability in Phase I scored higher than similar students in Phase III on all five scores. Phase III students of lower ability were projected to do better than similar Phase I students on four of the five scales. Again, so few students were actually observed in the lower range that it would be misleading to infer that lower ability students in Phase III did better than those in Phase I.

Each of the four strand tests contained items which related to content scheduled to be taught in each of the four grade levels -- 3, 4, 5, or 6. Only

sixth grade students were tested. Thus, students in Phase I and II schools had very likely received science instruction under the new program in grades 4 and 5, as well as 6. Students in Phase III schools had likely received only fifth and sixth grade science under the new program.

In order to investigate whether previous years' instruction was responsible for the results described so far, a scale containing only the sixth grade items was constructed. This scale contained thirty items, nine from the Health Strand, eight from Physical Science, nine from Environmental, and four from Earth/ Astronomy. These were all of the sixth grade items on the test, including five NAEP items that were directly related to the curriculum. This scale had a mean of 16.3, standard deviation of 4.31, and reliability of .66.

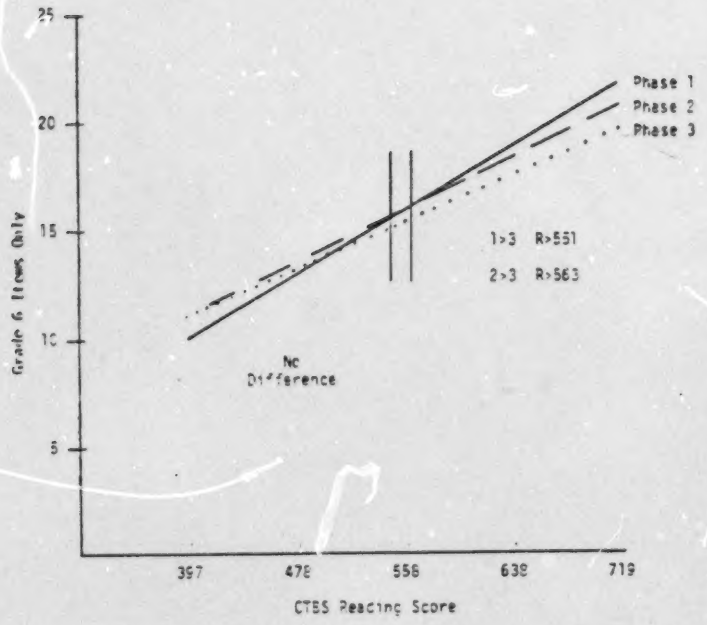
Performance on the sixth grade items only should reflect differences in the use of the program due to greater experience with the program on the part of the teacher. The sixth grade items have no prerequisite knowledge requirements from the previous grade levels that would give the students who had previously been in the program an advantage on these items.

Using reading as the covariate, the Johnson-Neyman procedure indicated that high ability Phase I students and high ability Phase II students out scored high ability Phase III students on the grade six items (Figure 15). No differences were found among moderate to low ability students nor between Phases I and II. The same results were found using CTBS math as the covariate, except no differences were found between Phases II and III.

Discussion and Implications

The analyses indicate that high ability students (those having scores above 550 on the CTBS reading test) in Phase I perform better than high ability students in Phase III on the Jeffco science test. There are no consistent differences between achievement scores for students of lower ability, nor between

Figure 15



Phases I and II or II and III.

The most straightforward interpretation of these results is that teachers with greater experience with the new science program are more effective with students of high ability, but experience does not make much difference for students of medium or low ability. This conclusion rests on the assumption that the Phase I teachers are implementing the program more fully than the Phase III teachers. Although we do not have Levels of Use data on the teachers of the students in this sample, it is true in general that the Phase I teachers had higher Level of Use data at the time of the testing than the Phase III teachers (Loucks & Melle, 1980). That is, more years of experience in use of the program

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by the teacher leads to better usage which in turn leads to higher achievement by the students.

The fact that the increased teacher experience had an impact on only the high ability students may simply be caused by the fact that better students typically gain more from most instructional treatments. An alternative explanation also seems plausable to the authors -- the multiple choice test is biased in favor of those who can read well. Students with high reading ability are able to transfer understanding of the scientific process into the testing situation, which depends heavily on a high reading ability. The students with average or low reading ability are not as capable of answering the multiple choice test items as the high ability students, even though they may be learning more science and gaining a better understanding of the scientific process in the new program. This explanation leads one to expect that the one-on-one test would have shown superior achievement in Phase I at all levels of ability, not just the higher levels. It may be possible to test this hypothesis in the future.

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COMMENTS FROM THE SYMPOSIUM DISCUSSANTS

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JOE VAUGHAN, DISCUSSANT REMARKS:

A couple of quick comments. I know Ann is going to say some more about some of this, but I would just like to encourage you all to read the papers. This session is unfortunately a very superficial glance at what the papers are all about and hopefully when they are taken back and perhaps edited a bit to eliminate some of the duplication and put together along with comments they might be much more helpful. I hope the audience will take the time to sit down and go through them in a very detailed fashion. Some of the questions that are in your minds were also in the minds of the authors, so please do take advantage of the full papers.

The second thing is that there hasn't been much said except in sort of a summary fashion about the nature, the kind of unique and positive nature of the collaboration that has been ongoing here. That perhaps needs to be brought out more in terms of a prototypical kind of process for this kind of research on the change process.

There are some problems incumbent in the kind of unique nature of this, though, that you have to keep in mind, it seems to me, when you look at those studies. Like the fact that the district itself is what I would call "change active," basically, and has had a high profile in terms of introducing a lot of innovations. It also is clear that this "change active" posture is evident to the district teaching staff and that they are, for example, even some district-wide curriculum innovations. It doesn't necessarily follow that individual teachers are all positive about change, but it does mean they know that's part of the atmosphere in that district. It may mean that there may be some sort of a head start toward implementation in a district like this and you have to keep that in mind when you try to relate it to other situations and other kinds of contexts. I think that is also true of the degree and the intensity of the CBAM staff intervention in Colorado. It is a very intense group and they spent a lot of time and money there. All of those things may well have distinct influences in and of themselves. So, it is unique in that sense.

I think that probably one thing that needs to be done is to cull from all of this the things that might be possible with a less intense effort, or at least examine the possibilities, the trade-offs, that have to be made financially, in terms of substance and in terms of degree of interaction. All of that because it was a bit idyllic in this situation. Also, the district agreed with a lot of the CBAM assumptions in terms of change over time and in terms of the sort of comfort and caring that went on by Jeffco staff in between inservice interventions. All of those things may produce somewhat of a bias in terms of these results compared with what might happen in "other school systems." All of those things have to be considered.

Another point I would make is that the nature of the curriculum itself perhaps offered an invititation to teachers to exercise a little more latitude, a little more discretion. It would be interesting to see what would happen when you get a much more tightly focused kind of curriculum package that some district may feel they do not want tampered with a lot and you get into perhaps a very different evolutionary and developmental process compared with what happened here.

A few basic questions. Many implications of this work for the future may grow out of some of the "outlier" findings. When you look through the reports and you look at some of the things that happened, why is it that only 1 teacher in 9 schools ever got to the Integration or Renewal levels, (that's Levels 5 and 6) of Levels of Use. One teacher in all 9 schools got there. What was it that kept others from doing that? A side question is "do we want them to get there?" Renewal has the possibility of changing the innovation. It can have the implication that people start to change the innovation to improve it. Change it to fit their situation. The district has to make a decision. If they are really sold on a particular innovation, do they want their teachers changing it and going away from what the district thinks will work best? So there are all kinds of value questions in there, too, that have to be addressed. An outlier feature of another nature is the example of a school that had 54% of its teachers at a nonuse level and one of the explanations given was they had a science resource teacher who stayed in the school all the time. Perhaps that science resource teacher was doing much of the work so nobody else bothered to pick it up. Another possible interpretation of that, though, is perhaps the teachers just never knew what the differentiation was supposed to be between the science person and themselves. That is, perhaps the principal or others never made it clear to them who was supposed to implement what and there had been no role differentiation or definition. A third thing might be that perhaps teachers, either individually or collectively, made a conscious decision that it was better to have the continuity of a science resource person working across all kids rather than segmenting and doing it on their own. There are all kinds of possibilities. I think we need to know a lot more about those kinds of questions.

Finally, I hope that when you read the papers there is one conclusion you reach that relates to the findings that have pretty well focused in on the principal and the need to look at the role next. In fact the CBAM crew is looking at that now. Some caution is in order, however, to look at the role and person in terms of how the principal interacts with a lot of other peo le and situtations. That wasn't really drawn out of this study. We have base-line data from the study upon which a lot of secondary analyses can be done. In terms of designing this second study, the follow-up study that relates to a principal, it might be important to look at questions like peer interaction among teachers and the influence that is in a school. I didn't see much of that in the report. It may have a great influence. There is probably much information of this sort in the ethnographic work that was done. On another point, the district policy, not just in terms of the stated policy but the degree of reinforcement that was given to that policy by the district (e.g., the following through on principals), might be important. Was there just lip service being paid to that policy? How much did the district push that? In terms of school resources, what were they and how were they used? That could have a very large differential impact. There was some mention of it, but again, it is something to be brought out in more detail.

Finally, we really don't have a clear picture of one respect of the work, configuration, that is, the nature of implementation and the degree to which something was implemented. Something may be used at a Routine Level of Use, but what is that something that is being used? When is it still the intended innovation? It could be a range from 20% of the original innovation to 80% or 90% of the original, so it may not tell you a lot to be able to say, okay, if you

get to a certain high Level of Use, then over an extended period of time you get such and such a result. Because you don't know, there isn't enough information given to you, about what that use was, the nature of it. It is not just a matter of how long you use it and what level you are using it. It's also the degree and nature, the configuration, of the innovation you're using. If you changed it drastically and you are using it in that drastically changed sense and another person is adhering closely to the original innovation design, what does that tell you? You really have to be careful to consider that. I hope that in collecting data in the future that is the kind of thing that will be added to the information base. I know that some of it is already there.

In closing, let me just add that I really believe that this effort reflects a genuine interest in and ability to do worthwhile collaborative research. School personnel and researchers alike shared common concerns and divergent skills. The results to date are of direct benefit to all concerned and it is because time was taken from the beginning to ensure continued rigor and active involvement. As I mentioned at the beginning of my comments, the potential of both the process and substance of this effort as a prototype is highly commendable.

ANN LIEBERMAN, DISCUSSANT REMARKS:

I do not think that there needs to be any defensiveness on Joe Vaughan's part here today. Several sessions have dealt with massive federal spending on school improvement. Much has been learned, and much has been spent. The research reported here, although costly will pay great dividends not only for the Jefferson County people and the Texas R&D Center, but for school districts really serious about the study and provisions for staff development and researchers concerned with utilization of their findings.

The papers presented here ought to be read in one sitting so that the reader can go from the design and plans of an Implementation Project to its effects on students. There is an abundance of material here.

I come to this session with a bias--both toward the panel members because of their valiant efforts at using research to aid schools and also because they (the researchers and the staff developers) are on the cutting edge of a collaborative effort that may serve as a model for us all. I care very much about both of these thrusts. They encourage a greater honesty and openness and the possibilities for better communication between the research and practitioner community.

The tension between the process of educational improvement and some eventual products (in this case use of a new approach to teaching science) are exposed in these papers, in fact laid bare so that we can see the complexities over time with a given group of schools. A focus on process alone reveals the nuances of educational change but one never knows when the journey is over. Just dealing with a product leaves out the fits and starts of how to get there. These papers attempt to do both and to a large degree are successful.

My comments revolve around three areas revealed in these papers: Collaboration, Implementation, and Staff Development. My reactions are aimed at those people whose major concern is the use of research findings for school improvement.

Collaboration

The papers reveal some important notions about how two institutions (Jefferson County Schools and the Texas R&D Center) can collaborate for mutual benefit. The Pratt, Melle, Metzdorf paper describes their major concern for building a systematic process for implementation. At the same time the R&D Center has been interested in further enhancing their understanding of not only the concerns teachers have and how they use innovations but what the principal does to impede or facilitate the process. The data in turn has been used by both district and researchers alike. The collaboration not only shows the possibilities of using evidence to enhance implementation, but who has responsibility for what gets revealed. The Loucks, Melle, paper describes both district and local school responsibilities in implementation and the role of the research group. One gets a clear idea of the communication necessary to make an implementation effort work. Specific roles that people play in the process are described. This is

a substantial contribution! The collaborative effort must be both within the district, and the local school as well as with the researchers. The complicated give and take of revealing each others worlds is exposed in these papers--not without conflict, annoyance and unanticipated consequences. These are the kinds of descriptions we need. So we have a much clearer picture of some of the elements necessary in a collaborative process.

Implementation

The Loucks, Melle and the Hall, Hord, Griffin papers describe vividly why we need to do both qualitative and quantitative research if we are to enhance our understanding of the process of implementing improvement efforts in schools.

One sees the school simply not standing still for the researchers (teachers get transferred to other grades) and the beautifully worked out phases of the researchers get messed up. And one also begins to get a sense of the "ethos" of the schools and how this makes a difference in the process.

Let us not forget that these papers have built on a history of an attempt at understanding the implementation process. These papers are far more sophisticated than Gross, Giacquinta and Bernstein's findings that teachers need to understand the innovation, have the necessary materials, training and support. They add to our understanding of mutual adaptation (Rand Change Agent Study) by describing just what adaptations teachers and principals do make. Is Mechanical use as far as most teachers get? Or is it that we do not know yet how to provide for the higher levels? Would another subject like reading have produced different scores? When is implementation over?

The papers reveal some of the pieces of the puzzle. It seems clear that support from district to principal to facilitator in the way of inservice, encouragement, help, holding expectations--all of these are a part of the implementation process.

The Hall (et. al) paper provides more evidence that the traditional measures such as age, self-contained classrooms and socio-economic status do not appear to make a difference in the implementation process. What one does begin to see through the rich mini case studies is the complex world of the teacher. Table 2 on page 21-23 of the Hall (et. al) paper is worthy of study by researchers and practitioners alike. What one begins to see is the tremendous variability in principals behaviors and concerns. Consider the difference in "ethos" between a principal who appears "more comfortable with children than adults" from a principal who is aware of "the feelings and opinions of the teachers," "views teachers as dedicated leaders," etc. The links between principal, teacher, district and parents that make up the "ethos" of a school seem slowly to come into focus.

One word of caution. I urge the researchers to not be seduced into looking solely at the principal. The mini-cases tell much more--they begin to unlock not only our understanding of the link between principal and teacher but when we look at all the data we begin to see the maze of other variables such as district and principal expectations, roles people play, teacher's attitudes, some-

thing about science in the elementary schools, the amount of time devoted to implementation, differences in school personalities and more. Let us not forget the bigger picture while attempting to create and refine a potentially powerful instrument on principal's concerns.

Staff Development

For those of us interested in research and development, knowledge utilization and dissemination (the latest "in words" for school improvement), these papers have a great deal to offer.

1. Empirical findings can be useful in aiding staff development efforts.

2. Stages of Concern and Levels of Use can help pinpoint where teachers are at vis a vis an implementation effort. Scores on these instruments can give information to staff developers as to what kinds of inservice is most appropriate at what phases.

3. The language of awareness, management and impact concerns can be useful in sensitizing all members of the school community.

4. Meetings for teachers can be more highly individualized for teachers.

5. Once again we learn that top down mandates do not work.

6. Implementation efforts must be focused at the local school level. (How much evidence do we need?)

7. The idea that teachers have developmental stages is a powerful one. But it does not absolve use of a responsibility to still understand the unanswered questions of what experiences need to be provided for what phases?

The papers boast of a description of a successful implementation. As such, they need to be read, re-read and understood both for what they say about the possibilities for using research evidence for school improvement purposes and the myriad questions raised about the complexity of the school as a social organization.

PAT ZIGARMI, DISCUSSANT REMARKS:

A strength of this collection of papers is that it takes a comprehensive look at change in a school system from the student's perspective, from a teacher perspective and from a building perspective. Viewing the impact of a change effort from these three perspectives is an interesting model for us who are concerned with change in schools to follow in the future. This set of papers is also a model because it is a good example of collaborative research, intact collaborative research at it's best. Let me point out several behavioral indicators of collaboration. Three of five presenters today are practitioners. They work in public schools. Six of the twelve authors are practitioners who work in public schools. I think that that is an indication of the extent of collaboration that led to the finding being presented today.

The case study paper illustrates (Hall, Hord & Griffin), I think, the need to collect uniform demographic data on all of the schools, if the mini-case study format is to be followed. We don't know enough in the mini-case studies about what was done differently at each of the schools. The methodology though is, I think, particularly useful when one is studying change in a district where the innovation and many of the contextual variables are held constant because it offers us as researchers a good chance to look at explanatory factors for why differences occurred.

I think that one of the strengths of the CBAM model (Concerns-Based Adoption Model) is that it helps change facilitators set goals for what will constitute implementation or institutionalization. In this case the goal of the change effort was lowering informational, personal and management concerns. My question would be "how would the change effort have been different if the goal had been to raise consequence concerns, which is the next stage of concern?" How would we have designed th program differently and would we have had different or similar student, teacher and building ou comes? I wonder how Consequence concerns in teachers can be stimulated. I am concerned myself that few consequence concerns were raised and that teachers tended to be concerned with management of the innovation throughout the change effort. Why didn't more teachers reach level IVB or Consequence stages of concern? I am wondering, and I think that this comes out particularly in the Loucks and Melle paper, do teachers who reach higher levels of use (refined Collaborative use) actually implement more components of an innovation? That to me is one of the most interesting questions raised by these papers. In fact when we have teachers at management concerns are they only implementing 20 or 30% of the innovation and if they were to reach higher stages of concerns and higher levels of use would they in effect be implementing more of what the developers consider to be the innovation. The authors pointed out in the Melle and Loucks paper that when teachers who are focused on management concerns are at a mechanical level of use, the components of the innovation that they tend to focus on are related to planning, control of time, grouping patterns, the things that teachers can control. I am wondering again if teachers express consequence concerns and reach a more sophisticated level of use would they begin to deal with impact-oriented aspects of the innovation or aspects of the innovation that deal more directly with students.

A further question I have is "What staff development models work with teachers at different stages of concern?" The Hall, Hord and Griffin paper seems to suggest that in-classroom advisors or teacher consultants don't help teachers who have high personal concerns and that is a puzzling conclusion to me as someone who is very much an advocate of in-classroom assistance to teachers. I am curious as to why an in-classroom advisory working with a teacher who has high personal concerns does not in effect help resolve those personal concerns. The paper does suggest that they will help teachers resolve their management concerns, their concerns with the logistics of the program, but they won't help teachers with their personal concerns. I am curious about that. I am wondering what these papers point out to us about the various approaches to training teachers at different stages of concern.

Furthermore, the Hall, Hord and Griffin paper says that administrators are a key factor in the successful implementation of an innovation. Behaviors on the part of principals to set policy to help teachers resolve management concerns, to set long-range goals for their schools, all of those behaviors on the part of principals seem to facilitate the successful implementation of an innovation. How do we as staff developers or as researchers help principals acquire the skills needed to do those kinds of things? What are the staff development experiences we need in schools for training administrators in that way. Again, I am raising questions and I think the papers themselves raise a number of questions that we as researchers need to address.

QUESTIONS FROM THE AUDIENCE

Q: I realize that you were very much interested in moving the teachers along to a higher level of concern such as the Consequence and Levels of Use and so on, but being an elementary science educator first of all I am delighted that the school district implemented an elementary science curriculum. (LAUGH) Second of all, I am absolutely pleased to see that after three years, the majority of the teachers are at least operating from a Routine Level of Use, which is extremely unusual, given the three components of your science program. You have ESS, SCIS and teacher made materials, so you're looking at different philosophies from each of those programs. I think that we should carefully look at what was being implemented; you were implementing an awful lot. Not only inquiry-oriented programs, but you were implementing philosophy, and you were implementing, I believe, three different philosophical bents. So, you lifted me 9,000 degrees because I am absolutely delighted to see that those many teachers are operating at at least Level III. So don't be too hard on yourself. I have a comment about the reason you got a drop in your low reader scores. There is some research which has been done that shows if you ask a series of questions before reading tests, for example, and the answer to those questions are not in the reading test, the students will in effect learn to not bother to read faster once they discover that the questions don't have simple answers. Now, what I am asking is, when that happens, do the students refuse to study anymore? It could be that what is happening in the lower end of your distribution is that those kids aren't getting enough information, enough right answers if you will, out of the inquiry kinds of materials to keep them going. Perhaps what they do is merely not continue at the same level, or they tune out.

Harold Pratt: My knowledge is that we are not in sync with those kids. It is a style as well as a level, but I think it is implied. I think that they go together and with the higher level students I think we are very much in sync with them, so they are accelerating and picking up achievement. Those on the low end--maybe we are running counter to the grain of things. I am not sure that I can explain the decrease, I can sort of explain very small or low change, but I am not sure that I can explain the decrease.

Gene Hall: I can't get Harold or Archie to buy my explanation, but this finding is very similar to the one that Sue found in the study that she did several years ago with some math data, or I think it is. I like Gary's proposal, but I think that there is another part of it that has to do with change process. When teachers first implement an innovation they are probably at a Mechanical Level of Use, 60 to 70 percent of them, which means that they are working in a more structured way themselves and are doing more task-repeating and direction-giving to their kids. When first year implementers are that way then those kids are having a harder time learning and understanding the task (to go back to some of the recent teaching or classroom research) those kids are getting more structured instruction and can understand the task. As teachers move to a Routine Level of Use and they know where they are going, then they are not giving much structuring to those kids, so the lower conceptual kids aren't getting the task structure they need. Jim and I think that's a great explanation.

Q: I heard in the recommendations from the CBAM group a focus on individuals, with principals' influence on classrooms being the assumption. You pointed out that teachers' concerns perhaps parallel principals' concerns and you then suggest hypotheses that the principals might be creating a mirror of themselves in their schools, so that teachers have the same concerns. My first point is, I think you ought to be cautious about who is influencing who there. It may well be that the principals are reflecting the school concern. A little broader comment is that you have had a great deal of success by focusing on change in terms of individual concerns. However, I heard both critics say perhaps you ought to expand that concern to a concern about structure or climate or culture of the school, and I am concerned that you might try to look at principals as individuals instead of perhaps the function of leadership. You might pass over other structural characteristics of schools, like how decisions get made, how districts as broad structural, sociologic entities influence schools. So, I am not sure that the CBAM group bought into the concerns of the critics and I wanted to emphasize that.

Now I can go to the other side from a more sociological concern. I'd like to go back to a phenomenology of teachers, the individual world of teachers' concerns. I wonder what would happen if you studied the life of teachers using, say Chris Clark's ideas of how teachers plan and think, how they prepare lessons for the year, how in the first few weeks of the school year they kind of set a pattern, a flow of how their classrooms are going to work, and I would like to see how this research interacts with that personal view of teachers. You might start your ethnography at the individual teacher level and start it before the intervention comes in, accepting then what teachers are thinking about, not so much in relation to the individual innovation but a little broader, how they view the teaching/planning process and then see how the intervention interacts. It may be, for example, that some teachers are involved with very important things and you are getting in the way of some other important issues, especially the world where teachers are having to adjust because of some mega forces. Maybe they are dealing with great things and the innovation is just getting in the way.

Joe Vaughan: There has been encouragement to look at the kinds of issues that you are talking about, particularly the second stage study that is looking at principals primarily. It is important to look also at things we talked about regarding different organizational and structural features along with the roles, and the individuals in those roles. We must try to focus in, recognizing that it is a rather large realm.

Q: Other things that come out of the study have ramifications in the program design for another time. For example, the Jefferson County people will perhaps do something in the next year, a different type of thing, and as they design the program going on are there things that you have learned that perhaps can sharpen the beauty of the implementation?

Jim Metzdorf: I would like to say that we have already done that on some other programs, because as is the norm, things have already changed since this was put in. We have applied the basic model of implementation to other programs that have been implemented. The social studies program in the 3rd grade, special education activities and some of those things, and what we are finding is that the model in terms of a way of looking at helping support change has

borne out to be very helpful there. In terms of curriculum design, I am not sure anything has changed other than the use of trained inservice leaders and reinforcement of the model that was in place during the pilot and field test evaluation. Implementation is still being reinforced. Those things are continuing to go on. I think that is what we have learned from it. Another thing we have also learned is that, as Harold pointed out, we have to be careful as to how we monitor implementation by looking at test scores of students, that there is a lot of fuzz between what kids are doing and whether a program is implemented or not, and whether or not a direct correlation exists. This is still an ongoing debate within the district, which is helping. We have some people who are arguing that you monitor by looking at the test scores and we have other people that are saying no, you have to monitor by looking at what teachers are doing. We also have a little business developing configurations or what we started off calling "components," for new programs that are developed, so that our role in the development of programs is changing. We are developers and implementers, co-facilitating implementation with principals. That role is being defined in terms of the components or the configuration of the program. The question I have is more of an implication. We have a very well defined program though some teachers may even consider it very restrictive. In other words, the definition of what they are to do is so well laid out that it may get in the way. That may be what keeps them at the management level longer. It doesn't allow them to go on because, there is evidence from some of the Rand studies and others, that there is a need to adapt the program and make it their own, and we don't let them do that. I am curious and I have a tough position one way or the other. But if they can't do that it may have an impact which we are not aware of.

Q: The answer to my question may well be within the report, which I haven't read, but I am very curious about the politics, if I may use that word, when I hear that in reality there is a research community cooperatively working hand in hand with a public school system. I mean that didn't just evolve. I am curious as to who initiated that and what was the impetus there, because I am going to run out to my school district and model a similar thing. I would like a beginning.

Gene Hall: There are three different answers and we need David to do a sociological study of that. I am going to have an answer as a researcher, then Joe is going to have an answer as a project officer, and then Jim is going to have another answer. Basically, three different needs came together. I can give you some of the personal history as well, as we can all add some of the ties that lead to it, but it's really an example of mutual needs and overlapping resources tied with consistent support from a funding agency. We haven't had to have a wet finger in the wind for the last four years, trying to figure out which way we are supposed to move next, and that is in the midst of all the nonsense that certain funding agencies go through. So, for myself, I think that was the key to our being able to do it.

Jim Metzdorf: I think it was the mutual gathering together of needs and resources at the same time and the personal knowledge and trust that had already built up over other meetings of the individuals involved, or at least parts of the group. Some of us didn't know each other until we got together and since that time we have developed a good trusting relationship. We don't always buy into the other persons' ideas and that is what keeps the group going.

Gene Hall: You might tell them about the mutually agreed upon divorce.

Marge Melle: I will underscore the whole personal end of it. We had the finances and they voted to get together personally. I was the one person who was followed two years by an ethnographer; I had this alter-ego. Believe me that took a lot of personal understanding.

Joe Vaughan: That's really the reason for the suggestion that they need to pull out the reports and the data about the process. Let's document what happened and why it happened. To some extent there was obviously some luck involved. I don't think you can always count on a group of people like the two groups we have from the R&D Center and Jeffco, but there were certain elements. The R&D Center did a very good job of laying out some; they had a lot of epxerience in schools prior to this, dealing with other situations. They had concurrent experiences in schools and I think they learned from them. Jeffco people added things you couldn't buy for a million dollars, no matter where you went, in terms of structuring research, because they knew the schools and they could tell you whether you were crazy or not and they didn't hesitate to do it. None of these people would.

Marge Melle: And we were interested in research, and to me, from an implementers point of view, that's the essential ingredient.